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JPRS Report

Nuclear Developments

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JPRS-TND-88-002

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INTER-AFRICAN

Official Views Use of Nuclear Technology as Appropriate

51000008 Monrovia DAILY OBSERVER in English
19 Oct 87 p 7

[Article by Yahne Sangare]

[Text] Vienna—Mr. Abu Baker Abdel from Sudan, and head of the African section of the Technical Cooperation Unit of the International Atomic Energy Agency here in Vienna, has challenged the view that nuclear technology is not an appropriate technology for Africa because it does not meet the basic needs of Africa's rural population. "In fact," according to Mr. Abu Baker, the very opposite may be true.

From Nigeria, one of Africa's most powerful countries, to sophisticated Ghana, from uranium-rich Niger to war-torn Uganda, from Tanzania in the east to Sudan in the north, African governments are now using nuclear technology as a rapid and cost-saving means of meeting the health and food needs of their population in the rural areas.

Of the twenty-five African nations that are members of the International Atomic Energy Agency (IAEA), almost all of them have or are now receiving technical assistance in the use of nuclear technology for use in rural areas. And about 33 per cent of this assistance is in the field of agriculture, water resource development, and disease control in livestock.

In 1964 the IAEA and FAO launched a joint special programme for the specific purpose of providing technical assistance to member states in the use of nuclear technology to improve food and agriculture production in Africa.

Already the FAO/IAEA Joint Programme has an active project in animal production and health which is aimed at improving overall animal production through the isotope-aided research on animal diseases, using the Sterile Insect Technique (SIT) for integrated pests management.

While in the area of food preservation, a new pilot project in the Ivory Coast will attempt to reduce post-harvest losses and the promotion of safe food supplies by effective use of food irradiation.

"In spite of these programmes," says Mr. Abu Baker, "there is still the impression in many people's mind that nuclear technology is an advanced and sophisticated technology, and is far removed from the grim realities of the development problems of rural Africa." It is true that because nuclear technology is a frontier technology whose fruits are not immediately seen, some people believe that Africa's already limited resources would best be served by meeting more immediate needs. But Abu

Baker disagrees. "If it is now accepted that nuclear technology does greatly improve the food supply system in Africa, then African countries must undertake the necessary research today because these results will not affect food supplies for some ten to twenty years."

Increased Food Production

In several African countries, research projects are under way where radiation is being used to induce genetic mutations in plants in order to obtain higher yields and more disease-resistant varieties. And some of these are already being commercially used.

Subsistence Farmer

And this research, says Mr. Abu Baker, is not confined to only cash crops or cash-producing agriculture. The African small subsistence farmers are being helped to increase the productivity of their livestock. In fact a large percentage of the small livestock is raised in Africa by small farmers who use them for food or for leather. But these animals suffer from many diseases. And they also have a low level of reproduction. So using techniques of radio immunossay (RIA) African scientists in many countries are undertaking pilot projects to study these animals' reproductive functions while using ionizing radiation to fight parasitic infections. Already improvement is being seen in the reproduction efficiency of these animals, and this will improve the overall development of the rural areas.

Tsetse Fly

Another project which has received wide support and publicity is the tsetse fly project known as the Sterile Insect Technique (SIT) where nuclear technology was used to eliminate this pest. The project which was first launched as a research project in Burkina Faso, Tanzania and Zimbabwe in 1976, proved so successful that an FAO/IAEA programme funded by Belgium, West Germany, Italy, Sweden and the United Kingdom made possible the establishment of an actual control programme, in Vom, Nigeria in 1979. The aim was to demonstrate the biological control of the tsetse fly (BL-COT) by the use of the SIT to clear a 1500km² two [as printed] hospitals in Egypt, Sudan, Kenya and Tanzania. Instead of the traditional treatment of placing radium source around the tumor, the new Amersham Manchester, after loading technique calls for the use of seal sources which are radioactive, instead of radium. They are cheaper to use and safer than radium and can cure the disease quicker, and above all, it is very suitable for rural hospitals as the treatment can be applied by teams of radiologist and gynaecologists.

SOUTH AFRICA

Botha's Decision To Negotiate on NPT Viewed

51000007 Johannesburg *THE STAR* in English
24 Sep 87 p 11

[Article by David Braun, political correspondent: "SA Will Gain More by Signing Nuclear Treaty"]

[Text] Cape Town—South Africa would have a lot more to gain than any losses it might suffer by signing the Nuclear non-Proliferation Treaty (NPT) and staying in the International Atomic Energy Agency (IAEA).

That is what is behind this week's announcement by President Botha that the Government was ready to start negotiating to sign the NPT.

Move to Expel SA

Mr Botha specifically linked such negotiations with the outcome of this week's 31st annual conference of the IAEA in Vienna.

A move had been made to expel South Africa from the IAEA completely, denying Pretoria its remaining rights and privileges in the organisation.

The agency will take a full vote on the issue tomorrow.

According to South African sources Pretoria had been reluctant for many years to sign the 1963 NPT (adopted by most other countries in 1970), mainly because of reservations it had over safeguards inspections of South African nuclear installations.

In 1976, South Africa developed its own "unique" process of enriching uranium, and in 1977 the then Prime Minister Mr John Vorster and Pretoria had certain objections to the implications signing the NPT would have for this process.

If South Africa signed, the processing facility and other installations would have to be subjected to regular international "safeguards" inspections.

There was a further implication for South Africa in that the NPT made provision for exchanging certain scientific information on nuclear technology, making it theoretically possible for Pretoria to be obliged to share its special processing secrets.

When South Africa was first thrown off the board of governors of the IAEA and then, in 1979, its credentials were rejected at the agency's annual conference, South Africa's attitude towards not signing the NPT hardened.

The move this year to suspend South Africa's remaining IAEA privileges (in terms of the rejection of credentials, South Africa could not take part in the general conference but was still entitled to attend and receive all the documentation, as well as take part in technical committees) prompted Pretoria to reconsider its position.

In the first instance, the special enrichment process was now a decade old, so probably no longer so "unique."

Secondly, there could be certain benefits, including the exchange of technology in favour of South Africa.

Installations Under Safeguards

South Africa therefore informed certain nuclear supplier countries, including the United States, Britain and Switzerland, that it was ready to start negotiation with a view to signing the NPT and placing its nuclear installations under full safeguards.

A major concern expressed to these countries, though, was that South Africa should continue to enjoy membership of the IAEA.

The developments this week, and the outcome of the vote, will not affect the separate safeguards agreements South Africa has already signed with regard to Koeberg power station and the Safari I reactor.

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Greenpeace Urges Halt to Uranium Shipments to U.S.

51200007 Ottawa *THE OTTAWA CITIZEN in English*
27 Sep 87 p A10

[Text] Canada should suspend uranium shipments to the United States until that country can guarantee there's no way any of it will end up in nuclear warheads, says the environmental group Greenpeace.

Recent U.S. regulatory developments raise doubts about the issue, Greenpeace official John Willis said in a recent letter to R.J. Rochon, director of the nuclear division of the External Affairs Department.

Greenpeace released Monday a copy of the letter, dated September 23. Rochon said he had not yet received the three-page letter and declined comment.

Canada and the United States have a treaty stating that no Canadian nuclear material will be used for military purposes. It is one of several agreements Canada has signed to limit the proliferation of nuclear weapons.

Critics have argued for years that while Canadian uranium may not end up in American bombs, U.S. imports free up domestic supplies for making weapons and the spirit of the non-proliferation treaty is not being respected.

Federal officials have insisted they keep careful track of what happens to all uranium exports and ensure none of it contributes to military purposes.

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HONG KONG

Continuing Reportage on Daya Bay

Safety Body Rejected

51500056 Hong Kong *SOUTH CHINA MORNING POST* in English 13 Oct 87 pp 1, 2

[Text] China has no plans to establish an agency to monitor safety at the controversial Daya Bay nuclear power plant, a spokesman for the developers said yesterday.

The public relations manager of the Guangdong Nuclear Power Joint Venture Company, Mr Yu Jiechun, said no advisory group, regulatory or consultative, would be set up as a watchdog for the plant.

His comments conflict with earlier remarks by Chinese sources, who for more than a year have floated the idea of a consultative body with the possibility of Hong Kong participation.

The matter was further confused yesterday when a vice director of the local branch of the New China News Agency, Mr Mao Junnian, indicated that China would set up a consultative body with Hong Kong representation.

Mr Mao added that the construction problem at the nuclear site which forced work to be halted three weeks ago, would be resolved in a satisfactory manner and that plans were under way to form a Sino-Hong Kong body for consultative purposes.

While Legislative Councillors and pressure groups have frequently called for Hong Kong representation on the proposed body, China has never made clear its position.

Mr Yu said yesterday neither the joint venture company nor the Chinese government had ever considered an official body with monitoring or consultative functions.

"The idea of a consultative committee was recommended by the Daya Bay panel of Hong Kong's Legislative Council. That committee, it has been made clear, will under no circumstances be authorized to monitor or regulate the project," he said.

"Many Chinese officials had expressed support for that idea on many occasions, and it is really up to the councillors or the Hong Kong Government to do anything about it.

"We will certainly not be the one to set up that body. I can't say how we will be involved either, because it has not been established yet.

"We don't know of any 'advisory body' that is supposed to have both Chinese and Hong Kong members. That idea had never been in our consideration and as far as I know was never brought up by Chinese officials," said Mr Yu.

When asked how Hong Kong people might play a role in supervision of the Daya Bay project, Mr Yu said directors of the Hong Kong Nuclear Investment Company, including two Hong Kong Government representatives on the board, could help channel information and suggestions.

But there was no room for direct input from the territory.

The \$28.8 billion project came to a halt about three weeks ago when a construction fault was detected at the plant's foundation site.

Mr Yu said work at Daya Bay, which is about 53 km north of Hong Kong, would resume in about a week and repair of substandard sections of the power plant's foundations would follow.

He described the contractors' failure to install 316 of the required 576 steel bars into the reactor's base for the containment shell as a "non-conformancy."

"We call it non-conformancy to avoid negative implications that come with words such as 'incident' and 'accident'. What happened was minor and harmless and had little adverse effect on the project," said Mr Yu.

The building fault stopped work at the Daya Bay site and was the first mistake to occur since civil works began several months ago.

"The omission of 9.6 tonnes of steel bars represented less than two per cent of the steel required for reinforcement and is costing us no more than an extra 10 tonnes for remedial purposes," Mr Yu added.

The joint venture company, he said, had decided to adopt the remedial steps proposed by Electricite de France, the senior contractor in HCCM (the consortium hire to install the reactor equipment).

Electricite de France's proposal involves the installation of more steel bars at the second of five layers of concrete raft, with the faulty first layer remaining as it is.

Mr Yu said the French contractor had assured the joint venture company that the result would be the same as originally intended and fully comply with the required standard.

"The proposal had been submitted to the relevant authorities and neither the National Nuclear Safety Administration nor the Ministry of Nuclear Industry raised any objection. I expect final endorsement at any moment," he said.

The company's decision to go ahead with Electricite de France's proposed solution has put an end to local calls for an in-depth study into the causes and remedies of the construction bungle.

Convener of the Legco panel on the Daya Bay issue, Mr Wong Po-yan, said yesterday the group should conduct an on-the-spot inspection when remedies on the faulty construction are near completion.

He said a panel comprising Government and academic experts should also be formed to get proposals hammered out by the nuclear plant company to remedy the construction bungle.

However, Mr Yu dismissed the idea of an international team of experts investigating operations at the Daya Bay project as impractical and useless.

"An event that is so minor does not justify this sort of action. One must remember that accidents occur everywhere and are inevitable in a project that is so large and complex," he said, speaking from Shenzhen.

He said immediate notification of Hong Kong authorities or the Hong Kong Nuclear Investment Company, the China Light and Power subsidiary that has a 25 per cent stake in the joint venture company, was not deemed necessary because of the relative insignificance of the so-called "non-conformancy" event.

The problem at the construction site was first detected on September 14, when quality control checks revealed structural errors.

Hong Kong Nuclear Investment Company directors were given a report on October 7.

"We maintain the highest standards in all aspects of our works and all our staff are chosen by our contractor, HCCM. We have experts of the highest calibre monitoring every aspect, so there is really no need for anyone else to come into our project."

The Daya Bay power project, due to be ready for commissioning in 1991, would be two weeks behind schedule when work resumed next week.

Comment by Engineers

51500056 Hong Kong SOUTH CHINA MORNING
POST in English 19 Oct 87 p 29

[Text] The contractors for the Daya Bay nuclear power plant have given an assurance that there is no safety risk from the accidental omission of reinforcement bars during construction of the reactor foundations. But in this article a group of engineers and draftsmen disagree, expressing concern over the long-term effects. For professional reasons, their names have been withheld.

As a group of civil engineers, technicians and draftsmen, we were astonished by the disclosure that a total of 316 of the required 576 steel reinforcement bars were missing from the foundation raft for the reactor at the Daya Bay nuclear power plant, and we are extremely concerned about its adverse effects.

The construction of the Daya Bay nuclear power station is a complicated project, composed of various fields of advanced technology and skills.

Should a mistake arise, be it from the civil, structural, electrical, or mechanical work, its consequences will be hazardous to the future operation of the power station, and more importantly, it will endanger the lives and property of millions of residents of China, Hong Kong and nearby regions.

In order to obtain a thorough understanding of the incident, as well as an assurance of the enforcement of safety measures in future, we would like the Hong Kong Nuclear Investment Company (HKNIC) to release details of the entire matter to the public as soon as possible.

With reference to information already disclosed by the media, we would like to comment as follows:

— The explanation given by the planning and contract manager of the Guangdong Nuclear Power Joint Venture Company (GNPJVC), Mr Peter Littlewood, that the missing 316 bars comprised less than two per cent of the total 8,080 bars in the raft and that this would have little effect on the stability of the foundations, is irrelevant and misleading.

These missing bars are actually 55 percent of the 576 starter bar due to be installed and their omission is indeed a significant and serious error. Thus, the "explanation" given by GNPJVC makes us wonder if the standard of workmanship and level of quality control is up to international standards, as claimed.

— Generally, construction work is carried out by a team of contracting staff. The normal working procedure on site is that when the reinforcement bars have been fixed in the specified position, another team of engineering

staff, usually from the consultant, would then be responsible for checking if the quantity, size and location of the bars complied with the construction drawings.

If the reinforcements complied with the drawings, the supervisory engineering staff would then authorize the contractor's workers to carry out the placing of concrete.

Hence, if the omission of a significant quantity of bars was not discovered before concreting, as was the case here, it points to inadequate supervision or even the absence of any such supervisory measures.

We feel that the GNPJVC's statement, that the detection of the mistake in mid-September proved the effectiveness of the quality control procedure, is absurd.

We fear that it was only when the construction workers tried to install the steel bars on the second layer of the raft, matching with the starter bars on the first layer, did they realize the omission—and it was not the so-called quality control checks that uncovered the error.

Furthermore, such a complicated and important project requires a quality assurance system rather than just a quality control system. Does the GNPJVC have such a facility?

— Foundation work is the most important part in the construction of a building, and yet its structure, in general, is not exceedingly complicated.

We are shocked that the construction drawings could have been overlooked or misinterpreted and the construction work have been mistakenly carried out for such a simple part of the project.

Is there any coordination problem between the engineers and the construction staff?

What will happen if more complicated construction work is encountered at a later stage of the project? Should we expect more serious errors?

In fact, could it be possible that the incident was caused by the inadequate standard of construction drawings or some incorrect information having been given?

— The omission of 316 bars was revealed only because it comprised 55 per cent of the 576 starter bars, which were partly exposed.

How can one be sure, however, that none of the reinforcement bars now completely embedded in the concrete has not been similarly omitted, most probably due to the same cause?

We doubt that the GNPJVC can assure the public that the figure for the reinforcement bars embedded in the completed first layer of the raft is accurate.

— Owing to the complexity of building contract documents, when a slight error arises in a general construction project, the contractor, engineer and client often compromise and accept an appropriate remedial measure which may be slightly below the original design standard but which will still ensure the safety of the structure—so as to minimize any delay and monetary loss.

However, the Daya Bay error is a serious one and its consequences may threaten the lives and properties of millions of people. We definitely cannot accept a lower safety standard.

Regarding the remedial measure proposed by the Electricite de France design team—that additional steel bars be installed in the second layer—the team should produce technical proof that this remedy would be adequate in order to regain the faith of the public.

— The Hong Kong Government was notified of the incident only after a couple of weeks had elapsed. One wonders whether the status of the HK Government in the Daya Bay project is in fact respected by the GNPJVC.

It is suggested, therefore, that the Government should set up an independent body to monitor the construction work and should have local representation in the monitoring of the China team.

— We call upon the Chinese Ministry of Nuclear Industry and Nuclear Safety Administration (MNINSA) to investigate this incident thoroughly, and to make the result of the investigation public so as to clarify the matter to the residents of China and Hong Kong.

We hope that the MNINSA can increase its monitoring control over the construction of the Daya Bay nuclear power station.

The construction of the power station has already been accepted as a fact. We hope that the various parties involved in the project will do their best and keep their promise to construct a safe nuclear power station, and not a nuclear bomb that could explode at any time.

Should an accident take place in future, it would be too late then to start worrying. Furthermore, residents of China and Hong Kong would be the most severely affected.

Finally, we sincerely hope that the response and pressure from the public arising from this incident will neither result in any adverse effects nor discourage the GNPJVC from disclosing any similar problem in the future.

We hope that our views will be useful and that the Daya Bay project will proceed smoothly and safely.

Construction Fault Detailed

51500056 Hong Kong SOUTH CHINA MORNING
POST in English 23 Oct 87 p 5

[Text] The construction bungle at the Daya Bay nuclear power plant happened because of a combination of factors involving error, mismanagement and inadequate site monitoring.

Senior officials from the plant have confirmed in interviews with the SOUTH CHINA MORNING POST that there were problems in implementing design requirements in the project.

Despite checks and control in line with international standards, an inexcusable mistake had been allowed to occur, one which was withheld from the public until 25 days after its detection.

This is what happened.

A technician had misinterpreted a drawing by project designer Electricite de France (EdF).

Due to his incorrect instructions, engineers and workers managed to fit only 260 reinforcing bars into the first layer of the reactor base.

The drawing specified a spacing of 100 mm and 200 mm respectively for steel rods to be installed in groups of one and three. The resulting raft saw rods—316 fewer than planned—positioned at 400 mm intervals.

No supervisors of the contracting company or the developing company, the Guangdong Nuclear Power Joint Venture Company (GNPJVC), detected the wrong instructions.

No surveillance by independent consultants responsible for quality assurance discovered the structural faults before concrete was poured.

Spokesmen for GNPJVC insist the company maintained world-class quality control and quality assurance.

Mr Peter Littlewood, contracts and planning manager of GNPJVC, explained the difference between the two:

"A quality control team is the sort of team that would be involved directly at the working level. They will carry out tests and checks to make sure things are in accordance with drawings. They will test the quality of material and so on.

"Quality assurance is required to be an independent function. The team audits the systems and procedures that developers use."

The following is the sequence of events at Daya Bay:

Design non-compliance at the reactor base was detected on September 14 by contractors when it was discovered 316 of 576 reinforcing bars were missing in the number one reactor raft.

The executive committee of the GNPJVC held a meeting on September 24 to discuss the issue.

Directors of the Hong Kong Nuclear Investment Company (HKNIC), the Hong Kong partner of the project, received written notification of the non-compliance on September 26.

On October 9, a press conference was held in Hong Kong and the Legislative Council ad hoc group on Daya Bay was briefed by officials. The same day a report on the incident was published in a Shenzhen newspaper.

HKNIC directors promised to press for a full explanation from GNPJVC after a board meeting on October 15.

The Financial Secretary, Mr Peter Jacobs, told a Legislative Council meeting on Wednesday that the report could be expected by the end of next week.

GNPJVC officials said they would reveal all circumstances leading to the incident but were not planning to identify those directly involved or what action had been taken against them.

In the past 39 days, builders, project managers, developers, the Hong Kong Government, Legco's ad hoc group and the general public—in that order—had seen the first failure of the project since construction of the plant's nuclear base began last year.

It was a building incident, and a minor one in all fairness, but nonetheless one which took many by surprise and shook public confidence to a worrying degree.

Human errors are unavoidable in all construction works, nuclear or non-nuclear. What quality control and quality assurance programs ensure is that the errors are detected quickly and without fail and before any irreversible damage has been done.

The damage at Daya Bay was not detected at a public ceremony at the plant on August 7.

It was not discovered until weeks later and not disclosed until solutions had been worked out.

As far as that layer of the raft was concerned, the damage was irreversible. The reactor base as a whole, however, has not been damaged in a way that future development of the power plant would be jeopardized.

In fact, a solution to rectify the deviation has already been found—involving negligible costs and no great loss of time, spokesmen of GNPJVC have frequently stressed.

The proposed remedy of the authoritative nuclear firm Electricite de France guarantees compliance with the original design at the extra cost of some 10 tonnes of steel—an affordable sum in the \$1.7 billion contract for this phase of the project, and certainly a pittance in the overall cost of the \$28.8 billion.

But such an incident—the Chinese call it “a non-conformance event”—should not have given cause for a controversy, which is exactly what is surrounding it today.

The controversy today is not over the pros and cons of having a nuclear station at Hong Kong's border, or the costs and benefits of buying electricity from a Chinese-controlled nuclear plant.

The Daya Bay power plant is here to stay and will be Hong Kong's major utility supplier when it starts generating electricity in 1992, that is, if it works.

The question today is whether it's going to work—after all.

“The reason that China Light contracted to buy electricity from this power station is that the Hong Kong community will need this power. If the station does not work, we will suffer, we will have to find alternatives,” the Financial Secretary, Mr Piers Jacobs, said on Wednesday.

Probably few have any qualms about EdF's proposed solution. Many would say, however, that they are concerned with the way the matter has been handled, and the sequence of events which showed the Chinese developers to be less than forthcoming and the Hong Kong Government to be less than responsible.

“It is not for the Government as such to satisfy itself that the proposals meet all the requirements. This is for the joint venture company and for the Chinese nuclear authorities” to decide, said Mr Jacobs.

For now, there will be a news blackout until the joint developers are ready to release the full report on the causes of and remedies for the Daya Bay plant's first construction hungle.

Mr Yu Jiechun, public relations manager of GNPJVC, said in so many words that he would not speak to the press again until “the management had decided on a proper course of action.”

While Mr Littlewood explained the system of checks and control at Daya Bay, Mr Yu would not reveal the size of the surveillance staff or answer any other questions regarding project monitoring.

Mr Littlewood probably spoke to the press for the last time before the release of the official report when he explained circumstances leading up to the incident to the SOUTH CHINA MORNING POST yesterday.

Unless there is a satisfactory resolution and more importantly, honest admission of all errors, public confidence in the Daya Bay project will not be restored, nor will controversy subside.

Guangdong Manager's Report

51500056 Hong Kong SOUTH CHINA MORNING POST in English 23 Oct 87 p 2

[Text] Supervision and quality control for construction of the Daya Bay nuclear plant was theoretically adequate but could be less so in practice, an engineer of the joint venture project admitted yesterday.

Mr Peter Littlewood, planning and contracts manager of the Guangdong Nuclear Power Joint Venture Company (GNPJVC), defended the developers' system of checks and control, but declined to identify who had been at fault for the sub-standard works at the unit one reactor base.

The \$28.8 billion project, jointly developed by GNPJVC and a Hong Kong subsidiary of China Light and Power Company, has been halted since mid-September due to non-compliance of works with building designs.

Mr Littlewood said there were sufficient supervisory checks to prevent the omission of 316 reinforcing bars from the reactor base but a review might be necessary to minimize errors in future.

“The underlying procedures that we have are based in concept on procedures used in France,” he said.

“They are correct and adequate but we would have to review whether any development of these procedures might be necessary to meet the conditions of our site.”

He added that GNPJVC had always had a program of quality controls as it was a requirement for nuclear projects.

Mr Littlewood's defence of the developers' system of project monitoring came in the wake of criticisms that supervisory measures had been inadequate or absent at the nuclear plant site.

Engineers and legislators in Hong Kong questioned in particular the steps taken before concrete had been poured on the bottom layer of the foundation where 576 steel “starter” bars should have been installed.

“In this case, obviously the non-conformance was not detected before the concrete was poured. Ideally it should have been.”

"It wasn't detected as early as we would have liked it to but nevertheless it was detected at an early stage," said Mr Littlewood.

The mistake came about when an unnamed technician on site misread a drawing and gave instructions which led to an incorrect positioning of protruding steel bars at the first of five layers of reactor foundation.

The original design required that 576 rods be drilled into a roundish reactor be in groups of three and one, at intervals of 100 mm and 200 for the two groups.

The person involved, whom GNPJVC refused to identify, gave instructions to the effect that there was to be a spacing of 400 mm between the rods. Because of the wider spacing, less than half of the rods were fitted into the base.

Mr Littlewood stressed that the missing bars, weighing 9.8 tonnes, represented less than two per cent of "starter bars" for the first layer because a total of 500 tonnes was required.

"The information that I've given is relevant and not misleading," said Mr Littlewood in response to the claim that the omission of 316 bars was a significant error.

He added incidents of "non-conformance" were not unheard of, saying it was "quite common in civil work for small discrepancies to arise."

He said a French nuclear project with the same designer of the Daya Bay plant, Electricite de France, had seen an entire reactor raft completed before the detection of similar type of mistake during construction.

According to Mr Littlewood, there are separate teams of experts responsible for works and quality control within the contracting company as well as GNPJVC project management.

And on top of supervision by contractors and developers, there was also independent surveillance by consultants of the American engineering firm, Bechtel.

"Out of all the checks that were made, the check before the pouring of the concrete did not pick up the problem but the checks afterwards did."

"We have the contractor's (the HCCM joint venture of French, Japanese and Chinese companies) team on site, and then separately we have the GNPJVC team on site. In the JVC team we're supported by engineers of Electricite de France," said Mr Littlewood.

"Bechtel engineers don't go and check things directly on site. They don't check, for instance, whether the reinforcing bars are in the right position. They check our

procedures and systems, such as whether we have the necessary procedures and whether they are being followed. They have an auditing function."

— Will Daya Bay work?

Independent Probe Vetoed

51500056 Hong Kong HONGKONG STANDARD in English 31 Oct 87 p 1

[Text] A top official from China's nuclear safety authority said yesterday there was no place for an independent assessment of the remedial plans for the Daya Bay reactor raft blunder.

Deputy director-general of the National Nuclear Safety Administration (NNSA) Mr Shi Guangchang told THE STANDARD in Beijing that it was unnecessary to engage outside consultants to review the measures devised by Electricite de France (EdF).

"I have read some of the newspaper reports from Hong Kong on the incident," he said.

"There was a suggestion to set up an independent team of experts to probe into the incident. But we have already formed a conclusion on the technical aspects of the proposed plan."

On October 14, NNSA told the Guangdong Nuclear Power Joint Venture Company and other relevant departments that it had no objection to the "feasible" remedial plan devised by Electricite de France (EdF), he said.

The demand for an independent assessment came from the Legislative Council ad hoc group on Daya Bay, soon after it was found out that 316 reinforcement bars had been left out of the cement raft of the Daya Bay reactor building.

Convenor of the ad hoc group Mr Wong Po-yan told THE STANDARD he had expected a negative Chinese response to their demand all along.

"I personally do not insist on an independent investigation," he said. "When our ad hoc group first informed the Hong Kong Government of our desire, we were told by the officials there would be great difficulties in meeting our demands."

He stressed that it was his own view and he would discuss the development with his Legco colleagues early next week after attending the Basic Law Drafting Committee meeting in Guangzhou.

Meanwhile, a second inspection team from China's nuclear safety authority will arrive in Shenzhen next month to look into the reactor raft blunder.

The team will comprise five to six NNSA engineers. Apart from reviewing the "non-conformance" incident, the group will also assess other design plans submitted by EdF and Framatome.

Mr Shi said NNSA had requested the Daya Bay developer, GNPJVC, to prepare another report on the cause of the incident and the subsequent improvement measures.

It is evident that there are still problems with the company's quality control and assurance systems," Mr Shi said. "These are the responsibilities of the GNPJVC and its civil engineering contractor, the HCCM consortium.

"The incident would not have happened if the management was under good control."

Mr Shi said the report would be ready soon but no submission deadline had been set.

The GNPJVC executive committee discussed a draft report on the issue last Tuesday and its first deputy chairman, Mr William Stones, said the report could be finalized by early next week.

"If the issue is not handled properly and the problems with the management not identified, similar incidents may happen again," said Mr Shi.

But he said NNSA as a nuclear safety "regulatory agency" would not take action against anyone responsible for the incident.

At present an eight-member NNSA inspection team is already in Daya Bay to supervise the construction of the nuclear plant.

About 100 NNSA engineers in Beijing and about 20 in Paris are working on the issuing of the construction permit to the plant due January next year.

A limited work authorization permit was issued by the NNSA in July for civil engineering work on the reactor building at the plant.

Asked whether the incident would affect the issuing of the construction permit, Mr Shi stressed that there was no direct relation between the two.

"It all depends on whether the EdF and Framatome plans were satisfactory," he said.

Mr Shi also ruled out the possibility of a Daya Bay "supervisory" body with Hong Kong members. He said NNSA only agreed to the idea of a Sino-Hong Kong Daya Bay "consultative" team.

Last April vice-premier Li Peng said a consultative body could be set up in which Hong Kong people participated.

There was a suggestion to set up an independent team of experts to probe into the incident. But we have already formed a conclusion on the technical aspects of the proposed plan. Shi Guangchang, nuclear safety chief.

Guangdong Report Details

51500156 Hong Kong HONGKONG STANDARD in English 6 Nov 87 p 1

[Text] Three more Daya Bay construction errors—kept under wraps for 53 days—were revealed yesterday.

The mistakes were outlined in an investigation report by the Guangdong Nuclear Power Joint Venture Company (GNPJVC), which was submitted to the Legislative Council ad hoc group on Daya Bay yesterday.

They were disclosed as the Government announced it was satisfied with action taken by the power station's builders as a result of the construction error that left a large part of the reinforcing steel out of the first layer of the reactor raft.

Electricite de France plans to start pouring concrete for the second layer tomorrow, after putting in extra reinforcements to compensate for the missing bars below.

The report to Legco, called for at the height of last month's row over the original disclosure, also reveals that:

- Some of the reinforcement rods are several centimetres away from the locations set out in the plans.

- The reactor raft's outer area contains 255 more reinforcing bars than the drawings specify.

- Some of the bars are the wrong size. In 20 locations 32 mm bars have been used when 25 mm bars were specified; and in six places 25 mm bars have been used in place of the 32 mm variety.

The report does not address directly the councillors' demand for an independent assessment of the builder's proposed remedy.

It is largely an elaboration on what Mr Zan Yunlong, executive chief of the nuclear project, told a group of local engineers three days ago.

But Mr Zan made no reference to the three additional errors.

Two technical experts of the company will brief the Legco ad hoc group on the issue in an open session this morning.

The councillors will then meet the Secretary for Economic Services, Mrs Anson Chan—a government representative on the joint venture—in the afternoon.

Mr Peter Littlewood, GNPJVC planning and contracts manager, said: "The cost of this technical solution is really very small in terms of the civil work. In principle it is the responsibility of the contractor although we have yet to completely discuss the topic."

He guaranteed that the Hong Kong consumer would not be able to detect any increase in the cost of electricity as a result of it.

The ad hoc group also demanded that 100 percent quality checks, rather than sample tests, be conducted throughout the construction period.

Mr Ken Bridgewater, secretary of the engineers' institute, said yesterday: "We have no doubt about the proposed remedial measures on professional grounds."

"But we are dissatisfied with the reasons given by the Daya Bay nuclear plant management for the bungle because it is obvious to even the naked eye that such a large number of reinforcing bars were missing."

"During our visit we discussed long-term engineering management with the Daya Bay nuclear plant management. They are quite open to new ideas."

But Councillors Martin Lee, Jackie Chan and Dr Conrad Lam insisted that the arrangement was not acceptable. They said the issue should be discussed by the Legco members' in-house meeting next Friday.

The group's deputy convenor, Mr Chung Pui-lam said he, as a layman, could not make an informed judgement on the issue and had reservations about the remedy.

Monitoring Group Essential

51500056 Hong Kong SOUTH CHINA MORNING
POST in English 9 Nov 87 p 22

[Text] The resignation of Dr Conrad Lam and a threat by Mrs Jackie Chan also to quit the Legislative Council's ad hoc group on Daya Bay have pointed out the wide communication gap between the Hong Kong public and the project management, whose credibility is in need of repair. When news of the construction fiasco at the nuclear plant 50 km from Hong Kong broke more than a month ago, it became evident that the only guarantee against further mistakes was an independent international monitoring team. The Guangdong Nuclear Power Joint Venture Company (GNPJVC) complained that such an arrangement was not possible because the Chinese and foreign engineers hired for the job could carry out monitoring work scrupulously and without outside assistance—or interference. Now, as work resumes in Daya Bay, the need to have constant and thorough scrutiny is even more compelling. The nub of the matter is that a nuclear plant is a psychological threat to the

Hong Kong public which must be assured that its safety is not being compromised by shoddy construction, inept management and indifferent authorities.

More than a year ago when the ecologists and other lobbyists were campaigning hard for greater Hong Kong input in the Daya Bay monitoring scheme, project proponents dismissed the crusade as a practice in mass paranoia because they believed the plan was fault-proof since it was being built by a reputed French firm with technical assistance of the highest international standard. But so early in the ground work of the Daya Bay plant, flaws have already been detected and, worse, corrected not to the satisfaction of everyone without vested interest in its early completion. Just how little influence the public has in the project has been starkly illustrated by GNPJVC going ahead with the start of full construction over the weekend despite advice to the contrary by the Legislative Council panel. Even though the Hong Kong Government is also a partner in the scheme, its Economic Services Branch admits that it, too, has not been properly informed. Indeed until acknowledgement of the blunder in Daya Bay was made by a Chinese news agency, neither the Government nor the legislators had an inkling of what had been done—or not been done—at the project site.

The confession last week by a GNPJVC engineer that the crew was not properly trained even though work had gone ahead has been a most chastening reflection of the less than satisfactory attitude taken by the contract partners. Surely, a project of such magnitude and serious environmental impact should not have been launched unless everyone working there was qualified, from the foreman to the ordinary fitter. For a long time Hong Kong was promised the utmost in safety devices at Daya Bay, yet it is apparent that many of the basic requirements have not been observed. The public was told last week that the problem of the missing rods could have stemmed from the fact that an expert had gone on vacation, leaving his subordinate to fill in without the back-up to provide a sufficient project management team. Such an explanation, far from a balm, is a shock that erodes confidence in the Daya Bay plant. It is clear that the involvement of an independent and international monitoring group of experts still is essential.

07310

JAPAN

Report Encourages Increased Nuclear Safety

51600001 Tokyo KYODO in English
0335 GMT 20 Oct 87

[Text] Tokyo, 20 Oct KYODO—Japan's Nuclear Safety Commission, in a 1987 white paper report released Tuesday, urged stepped-up safety measures and accident-related research to prevent and deal with a major nuclear power accident similar to the April 1986 Soviet Chernobyl disaster.

The Science and Technology Agency-affiliated commission delivered its annual white paper to the Japanese Government Tuesday, setting down a seven-point policy aimed at improving safety measures at nuclear power facilities.

The latest report by the commission, set up nine years ago, ruled out immediate emergency measures. But it did recommend that plant officials review nuclear plant sites and structural designs as well as operational methods employed at these facilities.

Other proposals include an improved training program to ensure that plant operators and managers react properly in an emergency, general measures to take in such an emergency and research to predict the far-reaching effects of major nuclear accident.

In its 1986 report the commission cited faulty design and operational error by plant staff as the major causes of the Chernobyl nuclear reactor accident.

The latest white paper recommends that the Japanese Government make efforts to ensure that plant personnel will not violate operational procedures in the event of an accident, which the commission acknowledged could be caused by a natural disaster. In spite of the safety risks the inhabitants of Japan's earthquake-prone archipelago face, government planners doggedly pursue the present policy of developing nuclear power resources as an important energy alternative.

The Science and Technology Agency has mounted a major publicity campaign, designating October 26 as Nuclear Energy Day and has sponsored poster advertisements which state that nuclear power is the "energy for everyone."

According to Japanese statistics, nuclear power supplies the largest share of energy, accounting for over 26 percent of Japan's total electricity output. By the year 2000 the level is expected to hit 40 percent and then climb as high as 60 percent by 2030.

19738

Nuclear Cooperation Pact Signed With U.S.

51600002 Tokyo KYODO in English
0359 GMT 4 Nov 87

[Text] Tokyo, 4 Nov KYODO—Japan and the United States formally endorsed a new nuclear cooperation agreement in Tokyo Wednesday which will give Japan free reign over its U.S.-supplied plutonium and allow it to transport the toxic substance by air over Canada and Alaska from European reprocessing facilities.

Japanese Foreign Minister Tadashi Kuranari and Mike Mansfield, U.S. ambassador to Tokyo, signed the document which will replace the present one pending legislative approval in both nations.

The new agreement will provide Japan with a 30-year advance permit to recover and use plutonium used in nuclear fuel originating from the United States. It will also replace the current one, effective until the year 2003, which allows the U.S. Government to control the use and shipment of its plutonium sources for safety or security reasons.

Japanese Government officials regard the agreement as an important step in building up the country's nuclear power generating capabilities.

With the completion of Japan's own reprocessing facilities in Aomori Prefecture by 1995, Japan plans to establish an economical operation and ensure the commercial feasibility of nuclear power by the next century. The 16-article agreement, under negotiation since 1982, will allow Japan to use Alaska as a refueling stop for airplanes transporting reprocessed plutonium from France and Britain.

Alaskan Governor Steve Cowpar, commenting on the new bilateral agreement, said "the shipment of highly toxic plutonium poses a potential health risk to Alaskans."

He added that his state government will be calling on the U.S. Congress to see that the necessary environmental safeguards are considered.

"Those safeguards must include assurances that the plutonium is shipped in crash-proof containers and that a thorough examination of the health and safety implications of flights in and near Alaska is undertaken," Cowpar said in a statement.

The nuclear control institute released a report last August warning that the U.S. Government would permit Japanese plutonium flights via Alaska in spite of the fact that crash-proof casks have yet to be developed.

It said that a cask being developed for the plutonium shipments failed to survive a high-velocity impact test at a U.S. Government facility in 1986. It also quoted experts working on the project who said the development of a container capable of withstanding a realistic crash may not be possible.

Under the new pact, the United States will provide Japan with a 30-year permit to ship U.S.-supplied nuclear fuel to a third country for reprocessing, eliminating the requirement for prior U.S. approval for each shipment of plutonium for reprocessing in a third country.

Critics, however, point out that the U.S. veto right was valuable when Japan attempted in 1982 to transport by ship a large plutonium load from France to Japan without making preparations for escort or surveillance in the event of a terrorist attack.

The new agreement also includes an article stipulating that future Japanese exports of nuclear power-related equipment must be geared to peaceful, nonmilitary use, whereas the current document only extends to U.S. exports of nuclear fuel and reactor parts to Japan.

Under the pact, Japan agrees to step up safety procedures regarding processing and storage of plutonium to prevent the proliferation of nuclear material.

According to the nuclear control institute, the U.S. currently has legal control over most of the 85,000 kilograms of plutonium that Japan plans to recover from nuclear spent fuel by the year 2000.

The control also applies to some 80 percent of the 45,000 metric tons of plutonium Japan has asked France and Britain to separate from spent Japanese nuclear fuel.

/9738

BULGARIA

Kozloduy Nuclear Plant Reactor Activated

4U291851 Sofia BTA in English 1842 GMT 29 Nov 87

[Text] Sofia, Nov 29 (BTA)—Today the first 1,000-megawatt turbine outside the Soviet Union went into operation at the Kozloduy Nuclear Power Plant on the Danube.

One hour after the switch-on, the turbine reached its maximum speed. If the generator regulation and excitation systems perform well enough to satisfy the power engineers checking and testing them now, they will go ahead tonight with the most important part of the start-up: the parallel recruiting of the generator to the national power grid.

YUGOSLAVIA

Physicist Discusses Country's Nuclear Program

51003001 Zagreb DAN 15 in Serbo-Croatian
20 Oct 87 pp 24-26

[Interview with Dr Djuro Milanic, nuclear physicist, Croatian delegate on Federal Executive Council Nuclear Energy Commission, by Ratko Boskovic; date and place not given: "Croatia Not Against Nuclear Power Plants"]

[Text] Nuclear energy opponents have received wide publicity, while proponents are censured.

Since the beginning of October, following adoption of the Program for Development of Yugoslav Power Engineering to the Year 2000, with Projection for Development to 2020, by the Federal Executive Council and its verification by the chairman, this program has been undergoing public discussion (even though still classified confidential). Anticipated by some, but coming as a very disagreeable surprise to others, is the main finding of the Program that in developing power engineering to the end of the century, and even beyond, Yugoslavia can rely only on its own resources and that it must not build new nuclear power plants.

We discussed this with Dr Djuro Miljanic, nuclear physicist, instructor in power engineering, and Croatian delegate on the Nuclear Energy Commission of the Federal Executive Council.

[Question] Since the time when the federal secretary of national defense visited the Krsko nuclear power plant, there has been incessant speculation in Yugoslavia regarding the immediacy of a peacetime and wartime nuclear program. What is involved, a justified linkage or antinuclear imposture?

[Answer] Nuclear energy was again equated with nuclear weapons recently in a Yugoslav newspaper. Whenever people want to discredit nuclear programs, they equate them with military nuclear programs, even though

nuclear weapons were made long before the first nuclear power plant was built and despite the fact that Israel, a country who everyone is convinced has produced an atom bomb, has no nuclear power plants at all. The countries which have the weapon have special reactors for producing plutonium, only some of which is used to generate electricity. When the fuel of other nuclear power plants is "spent," it contains a mixture of various plutonium isotopes, and it is very difficult to make a bomb from this fuel. This is the case today, but this does not mean that the situation will not change in the near future. Processes for laser enrichment of uranium have now been developed at the pilot-plant level; this uranium can be kept "in one's garage," so to speak, and can be easily concealed anywhere, because it will no longer require either a reactor or the bulky machinery needed for conventional enrichment. After all, it is naive to believe that 50 or 100 years after the atom bomb was developed a large number of countries will not have become scientifically and technologically capable of producing nuclear weapons everywhere independently of nuclear power engineering. It is primarily a political question whether particular countries want to build nuclear weapons or not.

[Question] If there is little interest in the study of nuclear and other forms of power engineering, how would you as a teacher rate the level of education of the Yugoslav public for making a decision regarding nuclear power plants in a referendum that might be held?

[Answer] Generally speaking, the level of education of our public in power engineering is a very low one. Even our scientists who are professionally involved with this field are unfamiliar with the basic orders of magnitude. Discussion is pointless in such a situation. Few good articles on power engineering are published in the newspapers. Very often it can be seen that journalists are unfamiliar with the most basic things about which they write. For example, reference is made erroneously in the Program for Development of Yugoslav Power Engineering, probably as a result of a typographical error, to Uranium-308, which does not exist at all, but the newspaperman copied the sentence verbatim. It was a question of an entirely different material, uranium oxide, U-308.

[Question] We can agree that the average Yugoslav does not know much about nuclear power engineering and that he adopts an irrational and emotional attitude toward it on the basis of this knowledge. But nuclear power plants themselves cause uneasiness among the public, and should this fact not be taken into account?

[Answer] This fear unquestionably must be taken into consideration, but the people must also be educated. Moreover, this fear is not a primeval one. It is acquired, learned, and those who are concerned with developing power engineering in Yugoslavia, the electric power industry and "the authorities," have not done much to enlighten the public.

I could not say how much the social calm in France on the subject of nuclear energy is the result of educational work, but we do know that the bitter quarrels in the Federal Republic of Germany about nuclear power plants are equally the consequence of a conflict of two industries, one which works with coal and the nuclear industry. In Great Britain the Laborites had a strong base in the mineworkers' union and consequently a strong antinuclear political platform as well. Hence the majority of the persons affected take positions in nuclear discussions in keeping with their own personal interests.

And so there is talk of an "antinuclear lobby" in Yugoslavia. There clearly is a certain number of people who are for nuclear energy and who will derive material benefit from construction of nuclear power plants. Similarly, there are some in this "antinuclear lobby" who stand to gain if nuclear power plants are built.

The most to be feared are persons who have individual interests. As we know, commissions on transactions are a regular feature of the capitalist world, and not just in the nuclear industry. Yugoslav industry is still unable to build thermoelectric power plants independently. The majority of them are imported, to say nothing of the coal mining equipment. And what has happened? Over the last 10 years, Yugoslavia has built coal-fired thermoelectric power plants bought from 11 different manufacturers in 9 different countries.

[Question] Is it not precisely for this reason that the Yugoslav nuclear program was differently designed and applied?

[Answer] An attempt was made with the nuclear program to bring about a major accomplishment for the first time at the level of the Yugoslav federation. Social contracts were concluded. The signatories were all the republics, all the nuclear institutes, and all the major design organizations. Ground rules were laid down as to who is to evaluate foreign and domestic market offerings for nuclear power plants. And then, suddenly, nuclear energy became something bad and undesirable, as if this program bothered someone precisely because it was at the Yugoslav federal level.

[Question] Let us turn to the genealogy of this change, as you have experienced it.

[Answer] My serious involvement with the Yugoslav nuclear energy program began when I and my colleagues at Yugoslav nuclear institutes evaluated the final safety report on the Krsko nuclear power plant. Later I was on a commission appointed by the Executive Council of Croatia to evaluate the fitness of the Krsko nuclear power plant for beginning operation. The Rudjer Boskovic Institute also has a place on the Nuclear Energy Commission of the Federal Executive Council. By virtue of his position, the chairman of the Federal Executive Council is the chairman of this commission, and I am serving my second term on the commission.

The power engineering development program started in August 1986 by decision of the office of the president of Yugoslavia. The first version of it dates from February 1986, and I now have four versions. I do not know if there were a fifth and a sixth version. Emphasis had previously always been placed on "rational utilization of domestic energy sources," and this program is based on maximum reliance on domestic sources. In my opinion, the rational aspect has been lost in transition from one program to another.

Reliance on our own energy raw materials appears at first glance to be entirely proper. But if we use our own energy raw materials exclusively, are we truly energy independent? The fact that we import more than 80 percent of our coal mining and transportation equipment indicates otherwise. Similarly, if we know the current prices of coal and uranium on the world market, and the program insists that these prices are also valid in Yugoslavia, we can show by simple calculation that we are not independent.

Operation of the Krsko nuclear power plant each year requires approximately 100 tons of uranium at 40 dollars per ton; this represents 4 million dollars annually, or 120 million dollars over the 30-year service life of the generating plant. Generation of the same amount of electric energy with coal requires 2 million tons of coal, which has 2 and 1/2 times as much heating capacity as does Yugoslav lignite. The cost of 1 ton of coal around the world is about the same as that of 1 kilogram of uranium. There would accordingly be an annual requirement of 80 million dollars, or a total of 2.4 billion dollars for 30 years. The petroleum requirement is about 8 million barrels, each costing around 20 dollars, so that the fuel cost for the entire service life of the power plant is approximately 4.8 billion dollars.

If 80 percent of the coal mining equipment is imported, and if accordingly the "foreign currency components" represent only a few percentage points in the cost of Yugoslav coal, we conclude that "reliance on our own resources" in the area of coal makes Yugoslavia financially more dependent on foreign countries than do pure imports of uranium, at least when we compare raw materials. The difference naturally lies in the capital which must be invested in the construction of a nuclear power plant. A high percentage of the money which must be spent to generate current must be invested at the very outset, but later, it is agreed in the majority of European countries, the current generated in the nuclear power plant is found to be cheaper when financing, fuel, and operating costs are taken into consideration.

[Question] Even when shut-downs of the nuclear power plant and disposal of the spent fuel or nuclear waste are factored in?

[Answer] The cost of shutting down a power plant at the end of its service life and the cost of storing fuel and waste are taken into account in the OECD documents

which discuss the cost of current generated in nuclear power plants. Because with coal it is necessary to consider the opening of mines, land reclamation, environmental protection standards, and so forth, the costs are comparable to those for nuclear power plants. If all these figures are accurate, we do have a subject for dispute. But unfortunately no such analyses have been made for Yugoslavia. If one does exist, I have not seen it, but if you refer to the Program for Development of Yugoslav Power Engineering you will find that these figures have not been taken into account. This would be the first and most important thing to do for everyone making decisions regarding the strategic directions of development of power engineering. If we examine the OECD figures, which refer to coal of a quality 2 and 1/2 higher than that of Yugoslav coal, it seems logical to infer that generation of current with coal in Yugoslavia is even more costly than in Europe. But we must also take into consideration many other specific features of our level of economic development, and above all else we must compare energy sources and their relative costs.

What are other countries doing at the same time? The amount of 100 tons of uranium oxide needed to operate a nuclear power plant for 1 year can be stored in an area the size of a small warehouse. Consequently, fuel and independence can be secured for a long time with an amount of money which is small on the power engineering scale. Huge amounts must be spent for coal, and it is necessary to have mammoth transportation facilities and storage areas. France, for example, a country which is entirely dependent on imported energy raw materials, has opted for nuclear energy precisely because it assures her of the least dependence on others. Total independence does not exist at all.

[Question] How did the Nuclear Energy Commission react to the omission of nuclear power plants from the Program for Development of Yugoslav Power Engineering?

[Answer] The full membership of the commission did not discuss the program at all. Comments were made only by its working group, but as is to be seen from the text of the program, these comments were not taken into account, and they should have been. For example, we want to rely on our own raw materials, and this sounds fine, but the question is whether it is sensible in the 21st Century to have a large labor force employed in harmful and dirty labor, in something which could lose all economic competitiveness very rapidly with the development of new technologies (unless this has not actually happened already) and which could cause unimaginable social problems in a very large part of the population and in the poorest parts of the country.

[Question] And so the program has been submitted to the public for discussion without the nuclear power plants. Do you have any official explanation for this attitude toward nuclear energy in Yugoslavia?

[Answer] No, I have none, but on Thursday, 15 October, the federal minister of power engineering stated on Ljubljana television as one of the arguments for the Yugoslav position that "after Chernobyl" a tacit moratorium was imposed on nuclear power plant construction in the developed countries," from which it is to be inferred that Yugoslavia is merely following this trend. This is not entirely true, however. Construction of 10 new nuclear power plants around the world began this year. Great Britain started construction on 2 of them in spring, the East European countries and the USSR have not abandoned their ambitious programs for development of nuclear power engineering. France and Japan are continuing to add new plants to their programs, and among the developing countries India and South Korea are also continuing ambitious nuclear power plant building programs.

The first version of the Yugoslav program mentioned a possible beginning of construction of 2 or 3 power plants by the end of the century, as something parallel to the possibility of utilizing domestic resources. The next draft stated that we do not need a single nuclear power plant, but did provide for commencement of construction of such a plant by the year 2000. The most recent version states that we will not need a single nuclear power plant possibly until 2010. This progression in a single year obviously cannot be founded on any thoughtful consideration.

[Question] On what basis do you conclude that the Program for Development of Yugoslav Power Engineering does not take a rational stance toward nuclear power plants?

[Answer] I will give only a few illustrations. Wherever the program deals with Yugoslavia's search for energy raw materials throughout the world, it does not say that we must also search for uranium. The program mentions uranium only in connection with the Krsko nuclear power plant. Despite the assumption that uranium might still be found in Yugoslavia, although domestic raw materials are discussed, no mention is made of other nuclear power plants possibly being built. Thirdly, if we examine all the aspects of power engineering, including production of heat as energy for heating and various technological processes, even though some East European countries are already building nuclear heating plants and thermoelectric plants for large cities, nowhere is consideration even given to the possibility of generating heat in nuclear power plants. Consequently, nuclear energy is consistently excluded from the program, and the real reason for this is not apparent—it is not economic or ecological.

[Question] Can Yugoslavia soon slow down the growth of energy consumption, in keeping with the many publicly stated demands?

[Answer] Over the last 15 years, Yugoslavia has experienced a sharp increase in demand for energy (electric energy in particular), and in the program this trend is extrapolated into the future in a way that does not make sense. Take the example of electric current. Over the period from 1980 to 1985, when the gross national product grew at a rate of less than 1 percent per year, electric current consumption rose at a rate of around 5 percent. The plan covering the period up to 2000 calls for an average increase of 3.9 percent in electric power consumption. This increase is, I think, based on the assumption that we are now in a crisis.

The ratio of growth of the national product to increase in electric power consumption is termed the coefficient of elasticity, and over the last 5 years this coefficient was approximately 10. Over the period from 1985 to 1990 this factor is expected to be slightly higher than 1, and around 0.7 after 1990. This is 1987, a year in which electric current consumption continues to grow at the rate of 5 percent, and the newspapers state that social product growth will not exceed 1 percent. Consequently, the current electric power consumption should be several percentage points lower over the next 3 years. This obviously is not only unrealistic, but would also be harmful.

However, quite aside from the fact that the plan is already off the mark, I believe that it is otherwise unacceptable if we want to get out of the economic crisis. Thus, the program is worthless if we want to catch up with the more highly developed countries. It is excellent if we wish to make certain that we remain poor. When we consider other developing countries, that is, ones which are slowly overtaking the developed countries, we find that the growth of their social product and growth of electric power demand are almost in double digits. New technology will, of course, contribute to lower power consumption, but a higher standard of living itself—and there are still parts of Yugoslavia which have no electricity—will lead to consumption of goods which use more electric power. It has taken the highly developed countries about 15 years to restructure their economies, and they still have not completed the restructuring process. Yugoslavia has not yet even begun the restructuring of its industry, and it will be more difficult for it than for others because of its poverty. Accordingly, if Yugoslavia wants to emerge from its economic crisis, pay off its debts, and begin to move in the direction of catching up with South Korea, for example, it definitely must increase electric power consumption, but it must consume this power efficiently.

[Question] What will electric power cost if there is not enough of it?

[Answer] The program states that the criterion for setting the price of electric power will be the "level of the average market price in West European countries." It is not entirely clear what this means, because when we look

a little closer we find it stated in another place that if enough funds for investment in the electric power industry are not found, "the option of mandatory pooling of funds may be exercised."

[Question] What is the position of Croatia, of which you are a delegate to the Nuclear Energy Commission of the Federal Executive Council, on the proposal that no nuclear power plants be built in Yugoslavia until further notice?

[Answer] While politicians who are against nuclear power have been given much space and publicity in the newspapers, this spring newspapers censured the president of Croatia for telling foreign newsmen that "Yugoslavia needs nuclear power." But I hope I am not wrong in saying that responsible people in this republic are not against nuclear power. Following objective examination of energy sources in Croatia and Yugoslavia, and of the consequences of investment or non-investment in nuclear power engineering—of what it contributes to the development of technology and industry as a whole, it was the position of responsible people in Croatia that this country needs nuclear power. The position of the heads of the other republics was the same. At the last meeting of the Nuclear Energy Commission, not one of the chairmen of the executive councils of the republics spoke out against nuclear power.

[Question] What comment do you have on the youth organization initiative promoting imposition of a moratorium on nuclear power plants?

[Answer] In trying to check the development of nuclear power engineering, the youth organization leadership is trying to check development in general, and this necessarily entails serious social consequences. It has been estimated in Great Britain, for example, that unemployment in that country will cause the death of 50,000 people by the year 2000. It is precisely because of such data that I advocate democratic discussion and disclosure of all the relevant facts, rather than countering one bias with another bias and demanding a moratorium without public discussion.

The authors of the program can be understood up to a certain point. It is clear that they were afraid of the task which they believed was set for them: "Rely on domestic resources and never mind that this will be very costly." Well, fine. I believe that the program is of poor quality in all respects, and if it were implemented in a situation in which Yugoslavia had begun to emerge from the economic crisis and was attempting to catch up with these "recently developed" countries, we would very soon be in the grip of an economic crisis which would throttle development.

Consequently, I believe that we should draw up a new program, because the current one cannot be improved at all. Its overall concept is wrong. The program bristles with erroneous figures. Nor must we forget its nuclear aspect, which is not considered at all as one of the available energy alternatives. On the contrary, everything is done to eliminate it.

A new program could be drawn up in a short time, but this time the Yugoslav specialists who are really the most competent in the area of power engineering should participate in its preparation, just as it is done elsewhere in the world.

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INTER-AMERICAN

Sabato on Argentina-Brazil Nuclear Cooperation Agreements

51002002 Buenos Aires SOMOS in Spanish
16 Sep 87 pp 40-42

[Interview with Deputy Foreign Minister Jorge Sabato by Daniel Santoro; date and place not indicated]

[Text] [Question] Is Argentina looking into the possibility of working with Brazil on the nuclear submarine project? That project was shut down in 1983, under the Radical administration.

[Answer] This is one of the complex issues that require more thought than others before they can be carried forward. Both in this area and in others, cooperation agreements would be a good idea. In any event, Brazil's project has at least a 15-year timetable.

[Question] And as for uranium, are studies under way for signing an accord with Brazil under which Argentina would deliver fuel enriched to 3.5 percent in exchange for the same elements but enriched to 0.85 percent?

[Answer] I must clarify that the news stories according to which Argentina will import enriched uranium from Brazil are not true. The talks have to do with buying and selling enriched uranium, which will optimize the yield of the nuclear power plants of both countries. Owing to a series of technical specifications, under such an accord we will be able to improve the use of our power plants.

[Question] Will our nuclear cooperation policy with Brazil be modified now that it has announced that it can enrich uranium and given that it may use nuclear power for nonpeaceful purposes?

[Answer] No. People mistakenly think something hidden and dangerous is involved when there is talk of a "parallel nuclear program." But this is how Brazil defines all of the research that it conducts outside the agreement that it signed with the FRG to build nuclear power plants. Brazil has developed new technologies for rounding out its mastery of the fuel cycle in a completely legitimate manner, just as Argentina did.

[Question] Are the large amounts of money spent on nuclear development justified?

[Answer] If our economy grows at an acceptable pace, when the crisis is behind us, we will begin to feel a shortfall in hydroelectric resources in 25 to 40 years. So we have to create our own scientific and technological nuclear capacity, so that we are not dependent on the major nuclear suppliers in the developed world for fuel. The technological difference between a conventional

power plant and a nuclear power plant is like shifting from a bicycle to a jet plane. Both Brazil and Argentina have one generation to master the technology of this nuclear field.

[Question] Why one generation?

[Answer] Because in 25 years, more or less, we will need 20 more nuclear power plants, which means spending tens of millions of dollars. But when we combine Argentina's needs with those of Brazil and other Latin American countries, we have to think in the range of hundreds of millions of dollars. Unless we develop our nuclear capacity, we are out of the picture.

[Question] How far has Argentina progressed in this field?

[Answer] It is more important to estimate how much further we have to the finishing line. From this standpoint, Argentina has not made such significant progress. It will be hard to reach the finishing line without joining forces.

[Question] Many wonder whether the finishing line will be peaceful use. At least for Brazil, which could reportedly develop an atomic bomb in 5 years...

[Answer] That assertion was made by the rector of the University of Sao Paulo, Jose Goldemberg, whom I know personally. He said that Brazil would be technically capable of building a bomb, which does not mean that it is going to. The cooperation agreement has the enormous advantage of being up front. The current climate between the two countries would not be marked by mutual trust had these accords not been reached.

[Question] Wouldn't the trust be broader if they had already reached an agreement on bilateral monitoring?

[Answer] You can't walk faster than your legs will carry you. This has to do with the needs and activities of the two countries. The monitoring that Washington and Moscow demand of each other is not the same as the safeguards that our countries may need. It all depends on the degree of conflict and trust. We were pleased that Brazil can now enrich uranium; it did not surprise us, because thanks to the cooperation agreements, our scientists knew that Brazil was working with high-speed centrifuge systems.

[Question] Is work under way for the creation of a joint nuclear waste disposal site?

[Answer] For the time being the concern is not so much the dump, because this is a touchy issue, but the need to join forces to resolve the issue of atomic-waste treatment technology, which is very expensive.

[Question] Brazilian President Sarney visited the Pilcaniyeu uranium enrichment plant. Is Alfonsín supposed to visit similar plants in Brazil as a quid pro quo?

[Answer] Yes, but not just this type of plant, because President Sarney opened all doors. But careful here, because the uranium was enriched in laboratories, and the investment phase for industrial-scale operations still lies ahead.

[Question] Has progress been made on the two-nation project to build a high-speed reactor?

[Answer] This is a very ambitious project, to be pursued in successive stages. We are now designing work timetables that will span several 5-year periods. We must continue these efforts because neither luxuries nor false national pride are involved. This is a necessity.

[Question] But the recently resigned president of the National Commission for Atomic Energy, Alberto Costantini, asserted that the Economy Ministry does not share this judgment.

[Answer] I don't envy the people who have to decide how limited budget funds are to be allocated. It is not easy to decide whether more money should go for a nuclear power plant than for a hospital. Ideally, we should be convinced that we must share sacrifices in a climate of generosity, but I will defend my area.

[Question] Are the rumors true that the developed countries have decided to promote a denuclearized area in Latin America?

[Answer] So far there is nothing about this issue on the agenda of the upcoming summit meeting of the Group of Eight. But such a zone has, in fact, existed since the application of the Tlatelolco Treaty, and it is an objective that all Latin Americans share. But implementing the treaty is a touchy matter, because when it was drafted, the field was not as developed as it is today. The purposes of Tlatelolco are shared; they are the same ones that we are pursuing under our accords with Brazil, and Brazil is pursuing them too, ours being the two most developed countries in Latin America in this field.

[Question] Cooperation with countries like Iran, which includes the export of nuclear components, has prompted international criticism. Will such agreements be modified?

[Answer] No. Argentina engages in such transactions very responsibly to prevent nuclear proliferation for military purposes. No country has criticized us, just some journalistic circles in those countries. It is untrue that we have transferred uranium enrichment techniques to Iran. At the request of the International Atomic Energy Organization, we did reconvert the core of an

Iranian research reactor and provide the fuel for operating it. We, along with the FRG and Spain, are also taking part in completing the Iranian nuclear power plant at Busher, but our involvement is not in the "sensitive" part of the power plant.

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BRAZIL

Funding Needs, Suppliers of Parallel Program Discussed

51002008 Sao Paulo EXAME in Portuguese
14 Oct 87 pp 57, 58

[Text] Overshadowed by the prospect that the country is far away from being able to manufacture the atomic bomb, the so-called autonomous, or parallel, nuclear program that was announced by President Jose Sarney on the morning of 4 September affected the industry like a display of fireworks: It was bright, noisy and fleeting. Not even the added news that the autonomous program will require annual outlays of \$40 million over the period of a decade beginning with the start of construction of the pilot uranium enrichment plant at Ipero (SP) in 1988 seems to touch a chord in those who traditionally would be potential suppliers. "What generates large orders are the nuclear plants, one of the most disastrous of all the programs of the Brazilian Government," states Silvio de Aguiar Pupo, technical advisor of the Brazilian Association for Development of Basic Industries (ABDIB).

With production capacity estimated at \$6 billion per year, about 60 percent of which is idle, basic industry would have plenty of reason to hold back this time (see inset). This would be the case even considering that mastery of the ultracentrifugation process for uranium enrichment—attained under a joint project of the Ministry of the Navy and the Institute of Nuclear and Energy Research (IPEN) at the University of Sao Paulo (USP)—is of undeniable importance if viewed solely from the standpoint of technological independence. "The chief concern is that it is questionable," observes physicist Jose Goldemberg, rector of the USP and head of the nuclear physics division of IPEN from 1973 to 1974.

Modesty Plays a Role

Traumatized by the consequences of the excessive enthusiasm with which it greeted the nuclear program designed with Germany in 1975, the industry has many reasons to remain prudent and not embark upon a new wave of euphoria. The first reason is that the enrichment of uranium is only a small part, though a strategically decisive one, of a nuclear program like that of 1975.

Second, but equally relevant, is the fact that the autonomous program, though conceived and initiated in the midst of a military regime, beginning in 1979, was not affected by the congenitally grand scope of the military projects. On the contrary. "The autonomous program is

modular and differs from the other one precisely in this regard," explains physicist Claudio Rodrigues, superintendent of IPEN. "It is a small program, modest by nature, and basically concerned with developing technological competence in the sector."

Due to these characteristics, Rodrigues admits, large firms are not excited over its prospects. "The problem is that the organization of a large company does not permit small undertakings, except those that require equipment and components that meet level 1 (the strictest) quality standards," explains Robert Muller, director general of BBC Brown Boveri, a multinational company of Swiss origin, recently associated with the Swedish firm Asca, and a traditional manufacturer of equipment for generating energy, including nuclear energy. With a chart in his hands showing that the rate of production of his industry fell from 2.5 million hours worked in 1981 to 1.4 million in the past year, Muller, nonetheless, does not fail to admit that "any program that may be established and actually implemented interests us."

Time for the Small Firms

For the present, however, the autonomous nuclear program must stick with the recipe by which it gained mastery of the ultracentrifugation uranium enrichment technology and which gives preference to micro-, small- and medium-sized firms. "We went out to get firms (approximately 150) that would be interested in small developments," says the superintendent of IPEN, Claudio Rodrigues. "The exception," adds Fernando Bianchini, executive director of the National Nuclear Energy Commission (CNEN), are the Votorantim group, supplier of hydrofluoric acid, the Fundacao Percival Farquhar of Governador Valadares, which produces beryllium oxide on a semi-industrial scale, and the Cetec-Fundacao Centro Tecnológico of Minas Gerais, which produces elemental phosphorous using apatite from Patos de Minas."

With orders being divided up among firms whose names are kept secret—"because there is great pressure on the domestic industries involved," reveals Bianchini—the autonomous nuclear program must not be viewed shortsightedly, as the significantly superintendent of IPEN suggests. "We are still very small, but in the future we will be able to compete with those that dominate the international trade in nuclear fuels for reactors, thought to be some \$15 billion per year, not counting the nuclear technology market, which amounts to \$100 billion dollars per year," estimates Claudio Rodrigues, suggesting that all this is in the hands of five or six countries that hold the technology for the entire nuclear cycle.

Submarine Reactors

Faced with a present in which nuclear energy is in decline and all the suppliers for this market produce more than they sell, the autonomous nuclear program holds out, in any event, reasonable prospects for the companies that do not assume a repetition of the inaction of the former program.

It is estimated that from 50 to 100 ultracentrifuges will be installed at Iperó. These machines are 1.5 meters in height, with a metal cylinder 50 cm in diameter at the middle, that works like a clotheswasher, but at very high rotating speeds. The cost of this initial stage will be between \$100 million and \$150 million and will allow the enrichment of uranium in sufficient quantities to supply the research reactors of IPEN and of other Brazilian universities. In the long term the goal is to enrich uranium for the development of submarine reactors.

This project will have an infrastructure similar to that of a chemical plant and therefore will involve the participation of various segments of industry. Thus, a uranium enrichment unit means, in practice, orders for large heating and vacuum systems, electronic flow and drainage controls, converters, hundreds of kilometers of pipes made of special materials, cylinders, safety equipment, sensors, etc. Still, no evaluation of the needs in terms of equipment exists as yet. However, implementation of industrial demonstration units to meet the needs of small-scale research programs can already be projected, according to forecasts announced by physicist Rex Nazareth Alves, president of CNEN and coordinator of the autonomous program.

However, according to the expectations of Admiral Othon Luis Pinheiro, manager of the project and the Navy's principal representative in the joint undertaking, what is being called a "parallel program" has everything to gain, including the prospect of making progress with installation of small nuclear energy plants (300 MW) at strategic points in the country, and in the process opening a vast market for the capital goods industry.

The Nightmare of the Accord With Germany

Twelve years after letting itself be carried away by the enthusiasm over the signing of the nuclear agreement with West Germany, the industry involved in the program is, at a minimum, disappointed. Recognition that the ambitious project had snarled is not recent. "We began to notice that all that activity was fading already in 1983," recalls Durval Jannuzzi, head of the Industrial Equipment Division of Cobrasma, a firm that was to have supplied 250 pieces of heat exchange equipment for the first four nuclear plants. Beginning from then, the nightmare began, not only for Cobrasma, but also for several other industrial firms. In order to accompany the hugeness of the program and to meet the quality standards in the nuclear realm, those firms invested heavily in the training of staff, developing their own suppliers and contracts with foreign companies. "In training alone we ran up 44,720 hours, and we would do well to recall that we have already lost about 20 percent of the trained staff," calculates Cobrasma's Jannuzzi.

Money Lost

Also, Confab Industrial—whose contracts for supply of tanks, ducts and evaporator systems for radioactive wastes of the Angra II and III plants would have totaled

up to \$60 million—is trying to retain its human resources, managers, and technicians, like a handful of hot potatoes. At the same time, that its management does not want to lose this valuable resource, there is no market to utilize it. "Our expectation is that that capacity is going to be made use of by the autonomous program," admits engineer Ayrton Bassani, director of the firm's equipment division.

As if all the uncertainty overshadowing the future of the disastrous agreement with Germany were not enough, a basic issue remains, which the industry still has not been able to resolve with Nuclebras, that of the payment for services contracted for and rendered. Confab, for example, has a credit of 3 million dollars. Even though the government vigorously collects from its debtors, it has proven to be, in this case as well, a most indolent debtor. "The money only comes in once a year," reveals Juan Carlos Natali, director of operations of Filsan Engenharia e Servicos, a Brazilian firm specializing in water treatment, which already manufactured 90 percent of what it was to have supplied for Angra II and III, for a total of 8.3 million dollars.

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Generator Failure Halts Nuclear Plant's Work

PY191719 Rio de Janeiro: O GLOBO in Portuguese
18 Nov 87, p 1

[Text] According to a timetable drawn up by the Siemens Company to repair an electric generator that experienced a short-circuit in June 1987, the Angra I nuclear power plant will only resume operations in October 1988. This information was supplied yesterday by Ayrton Caubit, the technical superintendant for nuclear matters of the Furnas Electric Power Plants, Inc. [FCE]

The paralyzation will cause a financial loss to the FCE totaling \$11 million (652.3 million cruzados): \$7.3 million in lost invoicing, resulting from the power plant's paralyzation, and \$3.5 million charged by the Siemens Company for the repairs.

The FCE may take further legal action against the Westinghouse Company.

Uranium Enrichment Plant To Operate in 1992

PY240059 Sao Paulo: O ESTADO DE SAO PAULO
in Portuguese 21 Nov 87, p 10

[From the Rio de Janeiro Agency]

[Excerpts] The first group of equipment of the Aramar uranium enrichment pilot plant, located in Ipero, 20 km from Sorocaba, will begin to operate at the beginning of 1988. This information was revealed on 20 November by Admiral Hugo Stofell, director general of Navy materiel. According to the Navy, the project is based on ultracentrifuge technology, and it has been cordoned off with every type of preventive security measure, above and beyond common practice for any type of nuclear activity. The first pilot uranium enrichment plant will begin to operate in 1992, and at that time it will be in a position to supply the annual load of uranium that is needed for a nuclear submarine. [passage omitted]

The Navy has confirmed what has already been published by *O Estado de Sao Paulo*: By the end of the 1990's the country will have its first nuclear powered submarine, but it will carry conventional weapons such as those that are used in submarines of other types. [passage omitted]

The Navy has already provided the equivalent of \$40 million to finance this project, and by 1992 this financing will amount to \$270 million. But of the \$40 million that has been spent up to November 1987, only 5 percent has been in dollars.

INDIA

Dhruva Reactor Not 'Dead' as Reported

51500069 Bombay: *THE TIMES OF INDIA* in English
31 Oct 87 p 5

[Text] Bombay, October 30—The 100 MW research reactor, 'Dhruva', at the Bhabha Atomic Research Centre (BARC) is operating at 80 MW, is not "dead" as reported in a section of the press, Dr P.K. Iyengar, the BARC director, said here today.

Dr Iyengar was enumerating upon the achievements of the centre over the last one year, at the Founder Day's function held here. The centre, originally named the Atomic Energy Centre, was dedicated to Dr Homi Bhabha in 1967.

"Dhruva had problems but with hard work they could be solved. Many persons, especially those who make their living only by criticising others, do not give us credit for the capability of doing things that have never been done before, just because we do not opt for foreign collaborations for every problem that comes our way," Dr Iyengar told the large gathering of engineers and scientists.

The year-long efforts to operate Dhruva at a satisfactorily high level of output had culminated in a relatively simple solution, he said. The reactor was now functioning by reverting to the original fuel design, after it had been suitably isolated, Dr Iyengar said.

During his speech, the director also outlined the front-line work that was being carried out at the centre in the field of robotics. These remote-controlled devices had already been installed in high radioactivity areas of several nuclear plants, he said.

The chairman of the Atomic Energy Commission (AEC), Dr M.R. Srinivasan, reminded the BARC staff that access to overseas developments in nuclear science and technology was virtually non-existent. He commended the BARC's R&D groups for giving the country's nuclear programme a large degree of self-reliance.

/06091

Nuclear Community Divided on Approach

51004710 Sydney: *TRIBUNE* in English 28 Oct 87 p 10

[Article by John Hallam: "India's Rebel Nuclear Industry"]

[Text] India isn't a place you instinctively associate with nuclear power. Yet India not only has one of the more ambitious nuclear power programs around, but the technology is all "home grown," and it is a program quite different in kind from what one expects in a so-called "third world" nation.

India currently has seven operating nuclear power plants, including the minuscule but important TBTR (Fast Breeder Test Reactor). In addition, India possesses a complete heavy-water and natural-uranium-based fuel cycle, uranium mines, fuel facilities (all India's reactor fuel is made in India), and small reprocessing plants.

And more is planned. Two more pressurized heavy-water reactors of "improved" design are due to come into operation.

Perhaps the most notable thing about the Indian nuclear program is that it is very much a "do it yourself" program. India has achieved what it has largely without overseas help. In this way it compares with India's other ventures into high-tech.

India has made forays into satellite technology (Indian satellites have been lofted into space aboard Soviet and French rockets), into computers (India has the largest number of software designers in the world) and electronics (India manufactures its own color TV sets and communications equipment). But whether this technological virtuosity helps ordinary Indians is an open question.

Nuclear Accidents

But the Indian nuclear program hasn't exactly been an unparalleled success. The two nuclear plants at Tarapur have been termed a "radioactive purgatory." Radiation exposure of workers at all India's nuclear installations has been too high. India's plants have been completed years behind schedule and way over budget, and their operating record has been uninspiring, to put it mildly.

And even if all this improves with the "improved" designs, the inevitable question will be "Will it all have been worth the billions of rupees that could have been spent on other things?"

A major bottleneck in the Indian persistent refusal of the country's heavy-water plants to function properly. India is unwilling to buy heavy-water from overseas as it comes with strings attached in the form of International Atomic Energy Agency (IAEA) safeguards, though it did buy heavy-water from the USSR.

Factions

Whatever the truth in Millhollin's claims, India's nuclear establishment is increasingly disenchanted with the slow progress of the Indian nuclear program, partly because of this, the Indian nuclear community is starting to divide into two major factions. One faction, led by the head of the BARC (Bhabha Atomic Research Centre) research establishment, Sri P. Iyengar, favors a "got it alone" approach. The other faction favors limited collaboration with other countries, notably the Soviet Union.

Government Foils Pakistan Call for Nonproliferation Notation

*51500070 New Delhi PATRIOT in English
31 Oct 87 p 1*

[Text] Kathmandu, Oct 30 (PTI, UNI)—India has thwarted a bid by Pakistan to write into the draft declaration of the South Asian Association for Regional Cooperation (SAARC) summit here a reference to military balance and call for regional security and nuclear non-proliferation in South Asia.

The draft declaration was finalised by high officials of SAARC member states as foreign ministers arrived here for a two-day pre-summit meeting beginning tomorrow.

"We have really no contentious issues before us," remarked Minister of State for External Affairs K. Natwar Singh.

Nepal's Foreign Minister Shailendra Kumar Upadhyaya, who takes over from India the chairmanship of SAARC's council of ministers, said: "We have made a lot of progress on the controversial subject of terrorism".

Conference sources said foreign secretaries had resolved the stalemate over the proposed convention on terrorism by agreeing to "a kind of enabling document" short of a binding legal instrument that India found hard to accept pending fuller examination.

"Sri Lanka is also happy about the enabling document," the sources said. Sri Lanka was insisting that SAARC countries formally undertake not to allow use of their territory for terrorist activity against a member country.

Till late last night, officials grappled with a Pakistan move in the drafting committee to bring in the contentious issue of regional nuclear non-proliferation.

The move followed statements attributed to Pakistani leaders that they had acquired the capability to produce the bomb.

For Pakistan now to advocate regional non-proliferation is "a propaganda exercise," an Indian official remarked.

Non-proliferation in India's view is a global—not regional—issue.

At the instance of India, Pakistan withdrew its amendment on keeping the region as a nuclear free zone.

About its second amendment, India invoked the SAARC charter to stress that bilateral issues were to be kept out of the SAARC forum.

Foreign secretaries making up SAARC's standing committee reported that they had been able to sort out certain doubts over the proposed food security reserve—the first step towards regional self-reliance.

The committee, which will formally adopt its report at a meeting tomorrow, has also set the parameters to limit aid from outside agencies for SAARC projects, the sources said.

The declaration calls for collective self-reliance and dependence on regional resources for SAARC programmes.

The foreign secretaries devoted considerable time in discussing the issue in the context of a Bangladesh proposal for setting up a multilateral investment institution like bank to borrow money from external sources.

They, however, agreed that external funds would be procured at the initiative of the SAARC itself and examine each case on merit.

It was also agreed that SAARC should go in for outside inputs only if these were not available within the SAARC region.

However, a mechanism could be established for joint collaborations for projects with outside agencies as distinguished from securing financial assistance from international agencies.

The declaration calls for programmes for the welfare of children and these should be integrated into other SAARC activities.

/06091

Nuclear Test Detected

51500055 New Delhi PATRIOT in English 6 Oct 87 p 5

[Text] The Seismic Array Station at Gauribadanur in Karnataka has recorded an event suggesting that South Africa may have detonated a nuclear device on 30 September.

According to sources at the Bhabha Atomic Research Centre (BARC) who don't want to be quoted, the event recorded on Wednesday had the characteristics of a nuclear explosion that was traced to the border between Mozambique and South Africa. The strength of the explosion has been estimated at 25 kilotonnes.

In the light of South Africa's professed nuclear ambitions the inference has been made that the device might have been exploded by South Africa.

The sources are awaiting confirmation from similar arrays in Australia and the United Kingdom. According to the sources, the Gauribadanur station can detect the location at 90 kilometers. The 30 September event generated signals with double hump typical of nuclear explosions.

/9738

Press Agency Sees Antinuclear Trend in Asia

51500053 Calcutta THE SUNDAY STATESMAN in English 4 Oct 87 p 7

[Text] New Delhi, Oct 3—An antinuclear campaign is gaining momentum in most Asian countries, including those of the Pacific, leading to changes in their foreign policies, reports UNI.

The assertion of new trends in "denuclearization" both at official and unofficial levels in all these countries ranging from Indonesia to New Zealand is a new phenomenon which over the past two years has gained much ground, according to a study conducted by the Institute for Southern Asia Pacific Studies.

Although the denuclearization process entails critical reassessment of military relations of some of the countries with the USA and is, therefore, "complex," a close scrutiny of media trends reveals that the foreign policy of at least some of these nations has begun to change, the study says.

The trend is significant as the establishment of a nuclear free zone in South-East Asia would make it possible to extend a "nuclear-free bridge" to South Asia.

The trend is important also because it has begun to surface even in those countries which either militarily or economically are even today aligned with some big powers. Another notable fact is that renowned statesmen, politicians, political personalities, scientists and experts have begun to evince keen interest on problems of peace and security in the countries of the region.

Change

Among other things the winds of change are evident in the Rarotonga Treaty which provides a sound basis for making the South Pacific a denuclearized zone, the Delhi declaration, activation of SAARC and independent policy stances of the countries, the study says.

Among the ASEAN countries, Indonesia has begun to change its foreign policy and would view more rapidly than other nations. Apart from floating the idea of a nuclear-free zone and consistently working towards it, Indonesia is also making positive advances to resolve regional conflicts such as the Kampuchean problem.

Evidence

There is also sufficient evidence to prove that Washington has failed to blunt the anti-nuclear edge in Indonesian policy. Indonesia is at present coordinating with other ASEAN countries to draft a treaty on establishing a nuclear-free zone in South-East Asia. The Indonesian leadership also has its own opinion, independent of the USA, concerning other problems of the region.

Similarly, the study said, New Zealand's decision to close its ports to American warships has caused panic in the Pentagon. It is believed that the U.S. anxiety over New Zealand's decision has been caused, above all, by fears that this "anti-nuclear fever" might spread to other U.S. allies, particularly Japan.

Anxiety is mounting in Australia too which is the USA's main ANZUS partner. In late 1984, the Nuclear Disarmament Party was organized in that country, which by January 1985, 28 Parliament members from the Australian Labour Party set up a group called "Labour parliamentarians for a nuclear-free Australia."

It is also significant that in April 1985 Australia officially refused to participate in the SDI programme of President Reagan. At present, 88 administrative councils in Australia have declared their territories nuclear free.

/9738

PAKISTAN

Commentary Details Acquisition of Nuclear Materials

51004711 Sydney TRIBUNE in English 14 Oct 87 p 10

[Article by John R. Hallam: "Pakistan—Cooking Up a Nuclear Bomb"]

[Text] In 1974, Pakistan's rival India, who had beaten Pakistan three times in war, most recently in 1971, exploded a "peaceful" nuclear device.

The device didn't look at all peaceful to Pakistan. At the time, Pakistan's Prime Minister Zulfikar Ali Bhutto, vowed that his countrymen would "eat grass" if necessary in order to match India's capability. Pakistan has been trying to duplicate the Indian feat ever since, though India has to a large extent retreated from a weapons capability.

While Pakistanis haven't actually eaten grass, it now seems likely that Pakistan has in fact achieved a weapons capability of some sort, probably using highly enriched uranium from cascades at the top secret plant at Kahuta near Islamabad, rather than the more usual plutonium route gone by India, and probably Israel.

Pakistan has recently been involved in trying illegally to obtain blueprints of Urenco's centrifugal enrichment plants via a German firm, Leybold Heraeus, who made vacuum pumps for Urenco. Pakistan has also been trying to acquire exotic bits of hardware via Swiss companies. A Pakistani agent was actually arrested in the US on July 14 this year for trying to obtain pure beryllium (an essential component in nuclear weapons), and maraging steel for the Kahuta centrifuges.

Stolen Blueprints

On May 4, 1987, Uranit, the West German part of the Urenco consortium, announced it was going to sue Leybold Heraeus GmbH for damages resulting from investigations by the Swiss and West German authorities into a scheme to steal Urenco blueprints and hardware for a plant to produce high enriched uranium at Kahuta.

It seems that Leybold got hold of blueprints of Urenco's cascades and much other equipment in the process of tendering for the supply of vacuum pumps. Leybold then got a Swiss firm, Metallwerke Buchs, to manufacture much of the hardware, including autoclaves, special steel containers, and de-sublimers, for export to Pakistan.

A large portion of this material seems to have been actually exported to Pakistan via French airports before February 1986. In February '86, autoclaves, de-sublimers, and other equipment was seized from Metallwerke Buchs premises by Swiss customs officials. According to the officials: "They could never have gotten that stuff from Switzerland to Pakistan legally."

Senior German officials later said that the confiscated equipment was definitely intended for use in enriching uranium to bomb grade. "The evidence unfortunately points to the conclusion that at least 93 percent enrichment was planned."

Pakistani Intentions

It seems that at least one critical bit of equipment, the de-sublimers, were a dead give-away of the Pakistanis' intentions. These de-sublimers were specifically intended for use with highly enriched uranium.

If this piece of equipment is used with low or medium enriched uranium, it will have a diameter of about 15 cm. But for use with HEU, a smaller diameter of 5 cm has to be used because of the possibility of accidental criticality with the larger diameter. The de-sublimers found at Metallwerke Buchs by the Swiss officials were of the 5 cm size. According to a Urenco official, "The configuration of the de-sublimers would be immediately apparent to any enrichment engineer who has a copy of a criticality handbook."

It seems that Metallwerke Buchs, when they manufactured the equipment, were told it was for wood impregnation! But according to a German official, "if the evidence stands up in legal investigation, Leybold Heraeus is finished."

There is more recent evidence of Pakistan's drive for a weapons capability. On July 14, 1987, Ashad Perez, a Pakistani agent, was arrested in Philadelphia in the US, for trying to persuade US companies to supply him with pure beryllium and maraging steel.

Suspicious

Suspicious were aroused when Perez contacted the Carpenter Steel Corporation of Reading Pennsylvania, to order a consignment of maraging steel. The corporation alerted US customs officials, who posed as steel company representatives, and apparently underwent a crash course in weapons requirements for the purpose.

In one conversation with them, Perez was asked if the maraging steel was intended for weapons production. He nodded, and offered a \$1,000 bribe. Later on Perez asked the disguised customs agents where he could obtain pure beryllium, which is used for reflecting neutrons. Both the beryllium and the steel were destined for a Pakistani front company operated by a 'retired' brigadier-general of the Pakistani army.

One reason for Pakistan's desire for maraging steel emerged back in April '86, when an ex-Kahuta employee gave an interview to the West German magazine STERN, in which he revealed that Pakistan is having problems with its existing centrifuges at Kahuta because the steel of which they are constructed is too weak.

Exploding Centrifuges

According to the interview, "Every week, there would be centrifuges exploding all over the place, because they did not withstand the tremendous centrifugal forces, because there were imbalances in the steel, or because of material fatigue."

In spite of the explosive propensities of the centrifuges at Kahuta, it seems likely that Pakistan now possesses a number of uranium-based warheads. The Pakistani government has itself made very contradictory statements—maybe deliberately, to generate just that edge of uncertainty in the minds of the Indians, and to give the U.S. Congress a legal figleaf in voting them aid.

In a recent interview, the head of Pakistan's nuclear program, Dr Abdul Quadir Khan, said that Pakistan now has a nuclear device more powerful than the one India exploded in 1974. And in TIME magazine interview in March '87, President Zia Ul Haq declared that: "Pakistan has the capability to build the bomb. You can write today that Pakistan can build a bomb whenever it wishes."

But Zia went on to say that Pakistan, presumably out of the goodness and purity of its Islamic heart, has not actually *assembled* one, and did not currently intend to do so. Presumably, Zia recognises that even the weak-kneed U.S. Congress would look askance at ready-to-use weapons, as distinct from all the bits to put one together in, say, one week.

The capability to do so is definitely there. U.S. government sources have estimated that the Kahuta plant has 14,000 centrifuges, and though the high failure rate is clearly a problem, at least 1,000 of them seem likely to be operative.

Pakistan says the Kahuta centrifuges are for supplying fuel to the planned 90 Mw PWR at Chasma but, paradoxically, 14,000 centrifuges is about 3,000 too few for this purpose, even if they weren't given to self-demolition, but it's plenty for making bombs.

Even if Kahuta has only 1,000 operable centrifuges, it will be able to make about 21 Kg of weapons-grade U-235 a year. A 'crude' nuclear 'device,' according to the IAEA, requires about 25Kg.

If Pakistan ever gets its 14,000 centrifuges going, it will be able to produce enough for about 12 devices a year. If, as has been reported in Pakistan's own newspapers, Pakistan has about 3,000 operating centrifuges, it can make 2-3 nuclear weapons a year.

The next steps in the process are assembly, testing (or computer simulation), and finally, delivery. Pakistan has the ability to perform all of these tasks.

[Note] John Hallam is a member of the Movement Against Uranium Mining—MAUM.

79738

BELGIUM

Delegate Criticizes Nuclear Cooperation With Pakistan

51002409 Brussels KNACK in Dutch
21 Oct 87 pp 20-23

[Interview with Pol Staes, member of the European Parliament, by Peter Renard: "...So That We Can Exercise Some Control..."]

[Text] According to Pol Staes, member of the European Parliament, there are indications that the Nuclear Energy Study Center (SCK) in Mol is providing Pakistan with the knowledge necessary to manufacture an Islamic atomic bomb. It is said that the Ministry of Foreign Affairs is not uninvolved in the matter.

"The SCK mission to Pakistan was not neutral, whatever they may say in Mol. We know with absolute certainty that the SCK delegation met with several persons there who are directly involved with military programs, among whom the top official of the 'weapons' division and the technical director of the Pakistani plutonium splitting project for military purposes. That is strange given that they were supposed to be talking about civilian programs. Besides, there is a possibility that the Belgian delegation may not have been aware of the fact that it was being manipulated."

This was written by Dr Rene Constant, director general of the National Radioisotope Institute (IRE), in a strictly confidential communication (dated 9 February 1987) to Minister of Economic Affairs Philippe Maystadt (PSC). This letter is one of the items in the file about Belgium's involvement in general, and the SCK's and the nuclear industry's in particular, in supplying nuclear technology to Pakistan. The file was opened earlier this year by reporter Michel Balthasart in the weekly LE VIF/L'EXPRESS and, given the low political response and especially because of the explosive situation in the Gulf, it is once again being dragged out of the dust by AGALEV [Live Differently] member of the European Parliament Pol Staes.

From 23 to 28 March 1986 SCK Director General Severin Amelinckx and his assistant Paul Dejonghe paid a visit to Pakistan at the invitation of the Pakistan Atomic Energy Committee (PAEC). There they signed a memorandum for renewed cooperation between the SCK and the PAEC. According to that agreement, the SCK has been providing 36/man/months of training for 7 PAEC scientists and engineers since 1 June 1986. The program is renewable annually. The training period amounts to 6 months or more. The housing and training costs are carried by the SCK.

In Pakistan, Amelinckx and Dejonghe paid a visit to, among other places, the Pakistan Institute for Nuclear Science and Technology (Pinstech) in Islamabad, the

Atomic Energy Minerals Center (AEMC) in Lahore and the Karachi Nuclear Power Plant (Kanupp). One of their conversation partners was Dr Munir A. Kahn, president of PAEC. Kahn is not unknown in this country. From 1972 until 1975 he worked for a Dutch firm associated with URENCO, a consortium which at the time built the ultracentrifuge uranium enrichment plant at Almelo (Netherlands). There Kahn was able to secure extremely confidential data about the enrichment process and he took those back to his country. Furthermore, he was trained by, among others, Professor Martin Brabers of the Catholic University of Louvain. Brabers worked for the SCK and also received an invitation from the University of Islamabad in Pakistan in November 1986. There, according to the British newspaper THE OBSERVER, Brabers again met Kahn who is said to have taken him around extremely secret buildings in Kahuta, where the Pakistani-Libyan bomb is probably being developed. Brabers said in THE OBSERVER that by May or June 1987 Pakistan should be considered capable of manufacturing an atomic bomb. Later he vehemently denied this. But President Zia-ul-Haq of Pakistan stated in THE INTERNATIONAL HERALD TRIBUNE: "It is not necessary to quote a Belgian scientist on this subject. Just write that Pakistan is capable of manufacturing an atomic bomb if it wants to. Once you have the technology, you can do whatever you want: you put that technology to use for peaceful or military purposes."

A cooperation agreement has been in existence between Pakistan and Belgium since 1963. Canada, France, the Federal Republic of Germany, and the United States have also helped Pakistan at the nuclear level. According to Severin Amelinckx in LE VIF/L'EXPRESS, the SCK distanced itself from India and Pakistan in 1974 when India demonstrated that it had an atomic bomb. But, still according to Amelinckx himself, in October 1985 at the request of the staff of Etienne Knoop, secretary of state for energy, the director general received Dr Munir Kahn who had first stopped by the Ministry of Foreign Affairs to ask for aid for civilian nuclear energy. This aid consists, among other things, of training trainees at Mol. At the present time there are two Pakistanis at the SCK.

Pakistan did not sign the treaty on the non-proliferation of nuclear weapons, the so-called Non-Proliferation Treaty (NPT). Hence, the country will not commit itself to not manufacturing atomic weapons. Furthermore, and this is rather important given the current constellation in and around the Persian Gulf, it shares Libya's and Iran's opinion about the manufacturing of an Islamic atomic bomb. Late last year the American journalist Bob Woodward, who is currently back in the news because of his book on the CIA, quoted from a report from the American intelligence services which pointed to the dramatic progress achieved by Pakistan in the production of nuclear arms.

As a matter of fact, Pakistan has been making great efforts for many years toward the production of an atomic bomb. In January 1972, the then President Ali

Bhutto called the top Pakistani scientists together in Multan asking them whether an atomic bomb could be manufactured in a few years. The answer was positive. Money for the project was provided by the Libyan leader Qadhafi. Pol Staes feels that the close contacts currently being maintained with Pakistan recall the "extremely controversial transactions and contacts between Belgonucleaire and Libya a few years ago."

[Pol Staes] Not too long ago, the SCK also sent experts to Colonel Qadhafi in Libya. On the other hand, the SCK also accepted trainees from Libya and Iran. At the time, Luc Gillon, member of the Board of Directors and of the Management Council of SCK, protested strongly against this. In his opinion, the argument for sending SCK scientists to Libya was unacceptable. The real reason behind it was that Belgonucleaire wanted to do business by all means. The personal friendship between the former deputy manager of Belgonucleaire and a Libyan national stimulated this kind of cooperation even more, said Gillon. The Libyan connection came to an end only when the cooperation caused a fuss and after the United States intervened.

[Question] Are there also ties with Pakistan?

[Staes] In July 1975, the French Embassy in Brussels received a telegram from the French Ministry of Foreign Affairs. According to that telegram, a Dr Kahn had declared in Paris that "thanks to the pilot industry developed in Pakistan with the aid of Belgonucleaire, Pakistan was able to manufacture the necessary plutonium to build an atomic bomb." As a matter of fact, Belgonucleaire had trained Pakistani engineers. They argued that this training was limited to "the operation and maintenance of nuclear power stations."

[Question] That is the same argument being used today by the SCK.

[Staes] Apparently the SCK did not learn anything from the fact that 10 years ago Kahn, who is generally assumed to be the current head of the Pakistani military nuclear program, already pointed to the direct relationship between the training of Pakistani engineers and the development of the Islamic atomic bomb. On the contrary: they calmly continue dealing with Pakistan and even specifically with Kahn himself.

[Question] In your opinion, have relations between Belgium and Pakistan increased since the visit of Amelinckx and Dejonghe to that country?

[Staes] That is obvious. Meanwhile, SCK experts have been sent to the Kanupp power station. In January of this year, Minister of Foreign Trade Herman De Croo (PVV) traveled to Pakistan with in his wake the unavoidable individuals from ASCO, ACEC, Belgonucleaire, and Belgatom.

Belgatom's purpose was the completion of the Kanupp reactor, which is specifically oriented toward the military use of nuclear energy. ACEC is more involved with Kanupp. In late June, a Pakistani delegation led by the prime minister came to Brussels. Their main purpose was the supply of nuclear technology to Pakistan. The media paid little attention to this visit.

In September, Minister of Foreign Affairs Leo Tindemans went to Pakistan. Finally, nuclear experts also went to give lectures at the University of Islamabad. One might wonder what those people did during their free time.

[Question] According to, among others, the trade director at Belgonucleaire, there is no obvious link between the civilian and the military aspects of nuclear energy.

[Staes] As trade director, Eddy Jonckheere knows very well that the opposite is true. Both aspects are inseparable, as Rene Constant of the IRE said in Fleurus. Given that the company he is working for does business with all three countries, Jonckheere should know better than anyone else how the Pakistan-Libya-Iran connection works.

[Question] You say that the SCK is exceeding its mission in its relations with Pakistan?

or General Amelinckx considers the training of trainees as part of working out trade relations, then I do indeed think that this does not belong to the mission of the SCK. Amelinckx says that it is not only his task but also his duty to develop contacts in the name of the SCK for our industry. Well, I say that it is the duty of the SCK to realize that Pakistan did not sign the Non-Proliferation Treaty, that there are ties between Pakistan, Libya and Iran, that there are tensions between India and Pakistan, and that the Gulf War has been going on for 7 years and is taking on ever more dangerous forms. Apparently, the only thing that counts for the state institution, which is what the SCK is after all, is trade, but then any kind of trade, in any kind of product. In fact, this once again demonstrates the extent to which the SCK is drowning in the ambiguities of the commercial-nuclear sector, and that the mutual threads of the nuclear lobby—either with private firms, or with state research centers such as the SCK, or in the heart of the Ministry of Foreign Affairs itself—cannot be separated from one another. A fusion has come about between the SCK, Belgonucleaire and Belgatom which leads to a single nuclear lobby, which is personified by always the same people who show up on the various boards of directors.

[Question] According to the SCK, the trainees in Mol are working in innocent fields, and the Kanupp power station is controlled by the International Atomic Energy Commission (IAEC).

[Staes] I am convinced that at the time when he was working at Almelo in the Netherlands, Munir Kahn probably also worked exclusively in totally innocent fields, when he ran off with the plans which later allowed Pakistan to put its military nuclear program on its feet. Kanupp is controlled by the IAEA. But does the SCK not know then that Pakistan is building a new nuclear power station specifically to escape from control?

[Question] You feel then that Belgium in its contacts with Pakistan is not paying enough attention to the Non-Proliferation Treaty which Pakistan refuses to sign, and as a result of which it keeps its hands free to build nuclear weapons?

[Staes] If we take a look at the "Report on the Mission to Pakistan of 23 to 28 March 1986" by Amelinckx and Dejonghe (dated 2 April 1986), we can only say that the two highest officials of the SCK were hardly mindful of that treaty at all in their cooperative dealings with the Pakistan Atomic Energy Commission (PAEC). It is hard to believe that after his trip Amelinckx stated that he did not know that he had talked to the top officials responsible for the military applications of nuclear energy in Pakistan. Moreover, they suggested submitting the agreement with PAEC only to the SCK Council, not even to the board of directors or to the responsible minister Maystadt.

Concerned Letter

[Question] You put the political responsibility with the minister of foreign affairs?

[Staes] The SCK is not acting freely at all in this matter. But there can be no doubt that the ultimate and greatest responsibility lies with the Ministry of Foreign Affairs. The file on the SCK-Pakistan connection contains a number of statements and hard facts which should have startled both the SCK and the Ministry of Foreign Affairs years ago. I am referring to the memorandum written by Mrs Herpels, head of the scientific section of the Ministry of Foreign Affairs, to the director general of the political section in the same ministry, after having read the mission report of the director general of the SCK and his assistant. She raised clear questions about the IAEA's ability to control and about possible consequences for Belgian relations with the United States. But in a letter dated 9 March 1987 and addressed to his colleague Maystadt (in response to a concerned letter from the minister of economic affairs of 19 February 1987), Tindemans literally answered: "The policy we are conducting with regard to Pakistan is aimed at not breaking off every cooperative tie with this country at the nuclear level, in order to be able to exercise some control and have privileged information available with regard to Pakistan's nuclear activities." Does Belgium want to take over the role of the IAEA then? Who will control it: Belgatom or Belgonucleaire? Did Tindemans make adequate control agreements with Zia-ul-Haq during his visit in September? The minister also answered

his colleague Maystadt saying that all cooperation in the area of plutonium and fast breeder reactors will be avoided. All things which could lead to the production of atomic bombs will be avoided. All experts agree that this is a guarantee which can never be made fast in practice. Tindemans did not say a word about the Non-Proliferation Treaty.

[Question] The Ministry of Foreign Affairs did not take the formulated objections into account then?

[Staes] Mrs Herpels' report is shattering for the agreement between the SCK and PAEC. But in practice nothing has changed. The report from the SCK office stated on 7 May 1986, that is to say 2 weeks after Mrs Herpels' report: "The matter was submitted to the relevant section in the Ministry of Foreign Affairs. Its reaction was that the 1963 agreement could serve as base for the planned cooperation." Mrs. Herpels said explicitly the opposite in her memorandum. Besides that agreement between the Belgian and Pakistani commissioners for atomic energy has yet to be ratified.

[Question] Mrs Herpels' report refers to possible negative reactions from the United States to the agreement with Pakistan, does it not?

[Staes] Pakistan is very important to the United States in terms of its policy toward Afghanistan. A significant portion of American support for the Afghan resistance is channeled through Pakistan. The United States is somewhat in a bind as far as Pakistan is concerned. On the one hand, they know that the country has chosen to side with Iran in the escalating Gulf War, and that a nuclear bomb could have dreadful consequences. On the other hand, Pakistan receives \$4 billion in aid from the United States, \$1.7 billion of which for military credits, spread over 6 years. Since the Soviet invasion of Afghanistan the United States has been forced to overlook some things here and there. And that in spite of the decision made by France, the Federal Republic of Germany, Great Britain, Canada, Japan, Italy, and the United States itself to limit the sale of equipment and technology which make the production of nuclear weapons possible. It is likely that in the meantime Pakistan has gotten its atomic bomb, and Belgium has collaborated in that.

8463

FINLAND

Temporary Storage of Nuclear Waste Starts
51002403 Helsinki HUFVUDSTADSBLADET in Swedish 30 Sep 87 p 11

[Text] Euraaaminne—Now that the first batch of spent uranium fuel is being transferred to Industrial Energy's new storage facility for temporary storage, Industrial Energy will be taking a historic step at the nuclear power plant in Olkiluoto, said Vice President Esko Haapala.

Now the firm can calmly make plans for the definitive future storage of nuclear waste. The storage facility, which cost 200 million marks, will be in operation for 60 years and it is big enough for the lifetime of the two Olkiluoto units.

But at the same time there are good opportunities for expanding the storage facility—where fuel rods can be stored for up to 40 years—in case the life of the Olkiluoto power plant turns out to be longer than planned or in case another unit is installed. Esko Haapala pointed out.

So far storage has occurred in connection with the two units, but this short-term storage site is beginning to fill up, the storage facility at the first unit is already filled with 180 tons of waste fuel, while the facility at the second unit contains 140 tons. At the same time 500 bundles of fuel with 89 tons of uranium are in use in one unit and 120 bundles are replaced annually.

In the fall seven more shipments of spent uranium fuel will be made from the first unit in addition to the shipment that occurred on Tuesday, the day after the Radiation Safety Center granted a use permit to the new storage facility. The shipments are made via special transport in a 93-ton container built in West Germany. A total of 328 fuel bundles will be transferred this year—a bundle contains 63 rods totaling 178 kg of uranium.

The shipment of spent nuclear fuel from the first unit in Olkiluoto, which has now begun, will take a week to complete.

When the container with the fuel bundles is moved to the temporary storage site it is submerged in water, after which the lid is opened and the bundles are transferred one by one to enormous basins made of reinforced concrete and supplied with an inner shell of stainless steel. The three basins are 13.5 meters deep and hold over 650,000 liters of water. There is also a reserve basin.

"The safety requirements for the storage facility are as stringent as those for a nuclear power plant and because we planned it according to our own standards, it suits us very well," Esko Haapala stated.

Because the storage facility's useful life is estimated at 60 years, it gives Industrial Energy, Inc. a good opportunity to closely supervise the future permanent storage of uranium rods in a way best suited to our conditions. There is also reason to bear in mind that development in the area is extremely rapid and that if some definite decision does not have to be made for a long time an entirely new and better solution to the problem of spent nuclear fuel may have been developed by then.

Industrial Energy has put 200 million marks into the new storage facility which has been in the planning stage throughout the 1980's since the negotiations with the Swedes concerning a joint solution to the storage problem broke down. Construction has taken four years.

The storage facility has a flexible construction which permits possible future expansion without much difficulty. The two units in Olkiluoto, with a capacity of 710 megawatts each, can provide for one-fifth of our electricity needs. And as we know they have worked very well.

But this does not mean that the company will not have to continue to ponder the final solution to the fuel question and for this reason the company will continue its test drilling operations in various parts of the country.

6578

FRANCE

Reprocessing Conference Eyes Output, MOX, Plutonium

Participants Discuss Policy, Costs

51002408 Paris REVUE GENERALE NUCLEAIRE in French Jul-Aug 87 p 406

[Article by F.S.: "RECOD 87—Prospects in Reprocessing"]

[Text] Six hundred and forty experts from 23 countries participated in the RECOD conference on reprocessing spent fuel held in Paris on 24 through 27 August. It was the general consensus that this event, organized by the French Nuclear Energy Society, was an undeniable success. As a matter of fact, it made it possible to precisely define the strategic, economic, and industrial data linked to the management of spent fuels and to size up future developments in an area closely linked to the development of the world electronuclear capacity.

A few relevant figures allow us to determine the stakes: by 1995 those countries with a market economy alone will have accumulated about 55,000 tons of spent fuel, and this amount will have more than doubled by the year 2000. It is true that during that same period, reprocessing capabilities will have increased but they will however remain clearly inferior to needs: these capabilities will amount to 4,000 tons per year by 1995 as against yearly needs estimated at 7,000 tons.

Three Arguments

This significant gap is not worrisome at all to those who believe that reprocessing is unnecessary and that the best solution consists in storing the spent fuel in the state it leaves the nuclear power stations. Reprocessing supporters oppose this position, specifically advocated by Sweden, with arguments which they consider decisive and which they developed at length on the occasion of RECOD.

—From an economic point of view, it is hard to decide between the two solutions given that at the present time their respective costs are about the same. But, with the

achievement of operational dependability of reprocessing, with the experience gained and the depreciation of the equipment, there is a trend toward a significant reduction in the cost of reprocessing. Thus, Jean-Pierre Rougeau, sales manager for COGEMA, was able to announce to the participants at the RECOD conference "a reduction in constant francs of 30 to 40 percent of the costs by the end of the current contract period" (that is to say toward the middle of the next decade). If this prediction turns out to be true, then the current costs of 6,000 francs per kilogram (COGEMA figures) would drop into the neighborhood of 4,000 francs, which would represent an undeniable economic advantage compared to storage as is, a less well mastered technology whose costs will for a long time to come remain burdened with the investments needed for its completion. —From the point of view of good use of energy resources, added the supporters of reprocessing, pure and simple storage is a real waste. As a matter of fact, it is possible to recuperate 96 percent of uranium and 1 percent of plutonium from spent fuel which can be recycled in the reactors. If it is not possible to consider using the plutonium in supergenerators in the short term, given the delay in the development of this system, the plutonium could be used in the MOX fuels—several electrical companies in France and abroad have already started doing this. In short, the spent fuels constitute a veritable energy deposit and it would seem totally improbable, in the words of Remy Carle, assistant director of EDF, that "at least in the long term, such rich substances as residual enriched plutonium and uranium will be allowed to lay dormant." —Finally, the supporters of reprocessing stressed that, from the point of view of safety and environmental protection, it is safer to recuperate the plutonium rather than to get rid of it in the form of waste. They noted that reprocessing induces a more rational and more easily manageable (solidification of fission products buried in deep seams) "looping" of the cycle than storage as is, which assumes an accumulation in time of storage pools and centers.

Waiting

Hence, many of the experts present at the RECOD conference agreed with Jean-Pierre Capron, general administrator of AEC, that "reprocessing is the only responsible approach with regard to the future generations."

At the moment, four countries have started on the road of industrial reprocessing. With a capability of 1,600 tons by 1995, France will have 40 percent of the market at its disposal as against 20 percent for Britain (800 tons) and Japan, and 12.5 percent for the FRG (350 tons). Other "nuclear" countries—among which the United States—have adopted temporary solutions which for none of them, including Sweden, involved decisions which would make it technically impossible to have recourse to reprocessing. Among those countries, some, such as China, have plans for the construction of pilot units. In any case, all of them are waiting to see the

development of nuclear power in the world as well as that of the market price of uranium before making a clear decision. 5, 10 or 20 years from now, something no country with an electronuclear park could avoid indefinitely.

Capacity Increase Needed

S1002408 Paris REVUE GENERALE NUCLEAIRE in French Jul-Aug 87 pp 407-408

[Text of talk given by Jean-Pierre Capron, administrator general of AEC, to the RECOD Conference in Paris, 24-27 August 1987: "Introductory Statement by Jean-Pierre Capron"]

[Text] Over the last 3 years, several major events have taken place in the area of reprocessing which have profoundly altered the panorama of the downstream part of the fuel cycle: industrial events with progress in the construction of large plants (Great Britain: Thorp; France: UP3, UP2 800), the start of construction of new reprocessing facilities (FRG, Japan), technical events with the satisfactory operation of existing installations (Japan, United Kingdom, France) and the incorporation of developed expertise in plants under construction or in the planning stage, and finally strategic events, such as the adoption by electricians of several countries (FRG, Belgium, Japan, France) of a policy of recycling in light water reactors of fissionable materials recuperated at the end of the reprocessing.

1. All of this will be fully discussed during the various technical sessions to be held over the next few days: for the time being, I would only like to draw your attention to a few points which seem to me to be determining for the development of reprocessing.

—First of all, it must be recalled that the choice between reprocessing and final storage for the management of spent fuel—a choice which cannot be made today with full knowledge of the technological facts given that the first of the two options has been studied and implemented, while the second one has never been tried—implies a decision of a strategic order about the future of nuclear energy.

The latter, which already plays a significant role in the production of electricity in numerous countries, is destined to become a vital component of the energy supply for reasons linked to the countries' desire to be independent in terms of energy, to the economy and to environmental protection. But nuclear energy will be able to play a role beyond the middle of the 21st century, approximate deadline for the exhaustion of known resources in natural uranium with the assumption of storing spent fuels, only if the management of its resources is optimized: such an optimization implies the recycling of fissionable materials contained in spent fuel.

In this perspective, reprocessing seems to be primarily a compulsory step to go through so that, in the long term, nuclear energy may be able to make a major contribution to the world energy supply. Up to now, numerous countries have rejected making any decision relative to reprocessing, specifically because in the current context of the availability of natural uranium this operation did not seem to be of an urgent nature at all. But, in the final analysis, the often implemented temporary solution of intermediate storage of spent fuels, in addition to not being without financial consequences, appears to have been nothing more than an illusion which can only make the implementation of a final solution more difficult. By 1995, the market economy world alone will have nearly 55,000 tons in spent fuel to manage and nearly 125,000 tons by the year 2000.

—The second point to stress is the operational dependability achieved by reprocessing in those industrialized countries which became involved in it through the construction and operation of pilot plants or intermediate size factories before building large capacity units: the United Kingdom, the Federal Republic of Germany, Japan, France.

Numerous figures will be presented to you to support this statement during this Conference, specifically by the speakers at this session. For my part, I will limit myself to recalling a few particularly important aspects of this operational dependability:

—henceforth it is possible to operate a reprocessing plant at its nominal capacity. Thus, the current BNFL plant in Sellafield and COGEMA's UP2 400 plant in La Hague have been functioning at nominal capacity for several years, if not above for the last few months at the UP2 400 plant;

—the progressive improvement of operating conditions, the result of experience gained and technical progress, makes it possible to reduce the impact of working plants on the environment, both in terms of doses received by the operating or attending personnel and of waste products;

—that the reprocessing costs are now well under control and should drop in time. For information only, in France reprocessing represents 23 percent of the cost of the fuel cycle and 7 percent of the cost per kilowatt-hour produced by pressurized water reactors;

—the experience gained, which is very important, is made the most of in the conception and construction of new plants.

—The short term industrial prospects confirm the determination of the countries which have chosen the road of reprocessing. As a matter of fact, four large construction sites, representing sizable investments, have been opened and have reached various stages of development. In the United Kingdom and in France, the two units with

respective capacities of 1,200 and 1,600 tons per year, are about to be put into service (1992 for Thorp, 1989 for UP3, 1992 for UP2 800). In the FRG and Japan, units of respectively 300 tons per year (Wackersdorf) and 800 tons per year (Rokkashomura) should be put into service in 1995.

Nevertheless, the more than 25 year gap with the programs of reactors where reprocessing fully reaches an industrial level results in an under capacity in this sector compared with the needs, the opposite of what is going on in the upstream stages of the cycle. By 1995, for example, the annual production of spent fuel in the market economy world will be approximately 7,000 tons per year, for a global reprocessing capacity on the order of 4,000 tons per year. This confirms the need to increase the reprocessing capacity: Japan, for example, expects the construction of a second plant by 2010.

—Finally, reprocessing is the only responsible approach vis-a-vis future generations. As a matter of fact, it makes the long term safe management of waste products possible, by separating the various categories of waste products according to their specific characteristics, thus allowing a technical and economic optimization of storage of each type of waste product, and by reducing to a large extent the volume of hot waste products compared to the open cycle approach.

Experiments With MOX, Plutonium

51002408 Paris REVUE GENERALE NUCLEAIRE in French Jul-Aug 87 pp 408-410

[Text of talk by Claude Aycoberry, director of the reprocessing department at COGEMA: "Reprocessing in France: Situation and Prospects"]

[Text] Even though the priority effort of the French actors in the area of reprocessing (the Atomic Energy Commission in charge of research and development, COGEMA, owner and operator of the plants, and the SGN engineering firm) are directed toward construction, testing and putting into service of the UP3 plant in La Hague, I will not say much about this major project which is the subject of several presentations made here, but I will start with a subject which primarily interests our British friends and ourselves, the reprocessing of gas-graphite fuel, because that is a hard school for reprocessors.

1. The Reprocessing of Gas-Graphite Fuels

On 31 January of this year, the last gas-graphite fuel slug was put in a dissolver at the La Hague plant which, since the beginning of its operation in 1966, has treated 4,894 tons of this type of fuel.

The specific gas-graphite installations at La Hague (unloading and storage pools, chemical decladding, dissolution) are in the process of being decontaminated and stopped. Henceforth, the Marcoule plant will reprocess

all the gas-graphite fuels produced by EDF and HIF-RENSA. By 30 June of this year, 3,153 tons had already been reprocessed there. Given the limits on waste disposal, which are stricter in the Rhone than in the ocean, the chemical decladding used at La Hague has been replaced at Marcoule by mechanical decladding in armored cells. The new decladding installation, put into service in 1983, the MAR 400 unit, is now functioning regularly at its nominal capacity of 17 tons per week.

On this subject, it is our experience that the difficulties of reprocessing gas-graphite fuels are no less than those of light water fuels. They are linked to the state of the reactors following unloading and the storage in pools of those fuel elements which combine two potentially dangerous materials, metal uranium and magnesium.

2. The Reprocessing of Standard Light Water Fuels at the UP2 Plant

The UP2 plant has been operating regularly for the last 3 years at an average rate of 40 tons per month, that is to say at its nominal capacity. By 30 June 1987, nearly 1,900 tons of light water fuels, the majority with nominal burn-up and generally cooled off for 3 years, had been reprocessed there. In March 1987, production was 64 tons of PWR, in May 52 tons of BWR. In 1986, the average dose for personnel working in a controlled zone was 156 mrem and the specific dose, ratio of collective dose to the electrical energy produced by the reprocessed fuels, was 0.08 man-rem/MWe per year. When this is compared to the specific doses received by uranium miners and the operators of nuclear power stations (at least three times higher and sometimes much more), it is obvious that, contrary to a rather widespread error, it is not in reprocessing plants that personnel working in the production of nuclear electricity are most at risk.

Those results are satisfactory, especially for those who lived through the laborious take off of the light water UP2 plant at the end of the decade of the seventies. Among the factors which contributed to this success one should note:

—first of all, the quality of the personnel. The bonds between the Operation Services, the Maintenance Services and the Security Services are extremely tight. The staff, particularly at the level of the engineers and upper level technicians, has been strengthened. Very serious attention is given to the continuous training of personnel;

—the fact that in France, responsibility for safety lies entirely with the company, which does not prevent vigilant control by the safety authorities;

—continued improvement in technology, particularly for all the mechanical operations in the plant's top units and plutonium finishing units, operations which are responsible for the majority of plant stoppages during the take off years;

—very rigorous preparation and implementation of maintenance and service. This is based on complete and up to date documentation, a supply of spare parts—the interchangeability of which is guaranteed—to minimize stoppages of the production line, and preventive maintenance based on experience. Exceptional servicing results in the development of models and carefully timed rehearsals by extremely experienced teams who develop their own tools and protective gear. As an example, we would note the servicing between November 1985 and January 1986 of the centrifuge extractor at the HAO plant where a dose rate of 14,000 rad/h beta-epsilon was registered. The collective dose estimated for that servicing was 25 man-rem, but the real dose for the 70 individuals who participated in the servicing turned out to be 23 man-rem.

The good operation of the UP2 plant gives us confidence to start the UP3 plant. The new difficulties expected at the onset are due to the change of scale, the sophistication of both the process and the technology which will make it possible to achieve a new threshold in matters of waste disposal, safety and productivity, and to the fact that the process' waste products will no longer be subject to intermediate storage but treated in the process.

3. The Reprocessing of MOX and High Burn-up Fuels

This being the case, reprocessors will, on the one hand, have to go along with the advance of fuels toward high burn-up products, which is in keeping with their traditions, and, on the other hand, prepare for the arrival of MOX fuels in their plants.

As a matter of fact, the medium term prospects for the development of light water fuels, such as can be estimated at the present time and by limiting oneself to EDF, are laid out in Table 1.

Table 1

Type of Fuel	Enrichment (U5 or Pu) (%)	Average Burn-up (MWj/t)	Maximum Burn-up* (MWj/t)	Feeding Period	Management (1/3 or 1/4 of the core)	Length of Cooling Off Period	Reprocessing as of:
U5 HTC	3.7	42,000	49,000	1988	1/4	5 years	1997
MOX 1st generation	5.25	33,000	39,000	1987-1992	1/3	3 years	1993
MOX 2nd generation	7.4	42,000	49,000	1992	1/4	5 years	2001

* At the level of the e.c.

The most significant problems resulting from this development are the following:

—for memory: problems of criticality and flow of plutonium;

—higher neutron emission, 35 times greater for MOX 2nd generation fuels than for the U5 standard fuel;

—higher alpha power: 15 times greater for the MOX 2nd generation than for the standard U5 fuel, the result of which is to limit the effect of the cooling off period;

—ever higher Pu 238 content: it is about 1.7 percent for standard U5 fuel, but it will be 2.5 percent for U5 fuel at 42,000 MWj/t, 3 percent for MOX 1st generation, 3.3 percent for MOX 2nd generation with depleted uranium, and 3.9 percent for the same fuel with reprocessed uranium. This increase in Pu 238 content will cause difficult problems at all stages of production, specifically at the final purification of the plutonium and at the dispersion stage;

—solubility of spent MOX fuel. This topical question will have to continue being the object of vigilant study conducted jointly by the reprocessors and the manufacturers of fuel elements, as the MOX fuels and their manufacturing processes develop.

COGEMA is getting ready to carry out a first experimental reprocessing campaign of 8 tons of MOX fuel from the German nuclear power station at Obrigheim in the UP2 plant. In addition, because of EDF's 1985 decision to recycle part of its plutonium in its light water power stations (the first loading of one-third of the core has been scheduled for September 1987 in one of the reactors at Saint-Laurent-des-Eaux), COGEMA has launched the construction of the chopping, leaching and hot extraction units of the UP2 800 plant, using MOX as reference fuel. This carries with it rather significant changes compared to the similar units of UP3, specifically at the level of neutron protection. UP2 800, which like the UP3 will be equipped with two chop-leach production lines, will function for the reprocessing of

MOX with two parallel lines, one processing MOX, the other U5 standard fuels, with the dissolution baths being mixed at the entry to the extraction process.

4. The Reprocessing of Supergenerator Fuels

From the moment that a plant was built specifically for the reprocessing of plutonium with an enrichment capability of 10 percent, the idea of studying the expansion of its possibilities to fuel from supergenerators, and first of all from the Superphenix, became essential.

The main conclusions of the preliminary planning study carried out on this subject were the following: this reprocessing should be possible, always through dilution in U5 standard fuels, following a cooling off of the supergenerator fuels of at least 5 years. The fuel elements will have to have been dismantled in a specific unit in such a way (as was the case for Phenix at the UP2 plant from 1979 until 1984) that what is presented to the chopping unit is bundles of rods in containers.

Thus it will be possible to get out of the chicken and the egg problem which has been an obstacle to the development of the supergenerator system: before getting involved with this system, the electricians legitimately asked for assurances about the reprocessing, but the cost seemed prohibitive in a specific plant with a capacity matching the few prototype reactors likely to be built over the next 10 to 20 years. On the other hand, the treatment through dilution should make it possible to achieve very competitive cycle costs for supergenerators once the reprocessing takes place in a plant which also has a significant light water loading schedule.

5. Economic Prospects

It is very understandable that after having invested massively in nuclear production units, the electrical companies are looking for any possibilities for savings in the management of the fuel cycle.

A major parameter in estimating the cost of the closed cycle is obviously represented by the current price of reprocessing and its foreseeable evolution. The analysis carried out by COGEMA on this extremely important subject has led to the following conclusions:

—the regular functioning of the UP2 400 plant at La Hague makes it possible to reasonably expect a good availability of future units;

—the satisfactory progress of the UP3 and the UP2 800 programs confirms the operational dependability of large reprocessing plants;

—following a 10 year depreciation period covered by the current contracts, the UP3 plant will have a significant capacity available to foreign clients. Even though a few preliminary investments should be expected then, it will result in a significant reduction in the cost of reprocessing by about the year 2000. This price reduction could be

as much as 30 to 40 percent for long term contracts. Of course, COGEMA's current clients will have a priority right of access at those new conditions.

6. International Aspects

As we have just seen, the reprocessing market is an international one, as is true for all industries in the field of energy which require heavy investments. Furthermore, the nature of its activities places it under the supervision of the relevant international bodies, the IAEA and Euratom.

As far as the future of this young industry is concerned, we can only congratulate ourselves on the excellent relationships which exist among reprocessors, the best demonstration of which is provided by the set of contracts to transfer European knowledge to the Japanese JNFS company.

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